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THE FLAT-FISHES OF CALIFORNIA.*

By EDWIN C. STARKS, Stanford University.

Though most of the flat-fishes on the California coast are known as soles, they are in truth all flounders but one—a very small one that is seldom taken and never used for food. The name sole seems to insure a better market than the name flounder, with the result that more and more of the flat-fishes that were once correctly called flounders are now called soles, and the name flounder is seldom used. The name flounder is used herein except in a few places where the name sole has been used so long it is firmly fixed.

The flat-fishes form a well marked group strikingly separated from all other fishes by one side of the head and body being white or almost colorless, while the other side is dark, and with the eyes both on the dark side. They lie on the sea bottom flat on the colorless side with the eyes and color on the uppermost side.

*A report of the Committee on Zoological Investigations of the California State Council of Defense.

When the flat-fish is born, however, and for some time afterwards, it is symmetrical and has an eye on each side of the head, while it swims back upwards as does any other fish. As it grows it leans more and more to one side, and the eye on the side toward which it leans gradually creeps over to the other side of the head. Though the eye only seems to creep to the other side, the whole skull in truth twists, and the part that is between the eyes is the part that is normally on top of the head in other fishes.

A peculiarity of the flounders of the western coast of North America is that several of them have an accessory branch of the lateral line that runs back from the head following under the base of the dorsal fin. There is a species in Japan with this characteristic, but otherwise it is found on flounders from no other part of the world.

The flat-fishes are widely distributed, and are found in nearly all seas. Some of them ascend rivers to where the water is scarcely or not at all salt. Some species, or groups of related species, have the eyes and color always on the right side, while other species have them on the left. A very few species have about an equal number of individuals colored on either side. On our coast are several with this uncertain distribution of color to either the right or left side.

A zoological key has been prepared for the easy identification of the flounders. For those who are unable to use the key there remains the method of hunting through the descriptions and pictures until one is found to fit the specimen at hand. It is urged, however, that the reader become accustomed to the use of the key. Keys are used in nearly all serious zoological books, and will be used in these papers where, as in the flounders, it is difficult to avoid their use. The key is arranged to consider alternative characters; one character being under a single figure (6) as contrasted with an alternative character under a double one (6-6). In long keys a second alternative is often used (6-6-6). If, in consulting the key, the characters under the first figure do not fit the specimen go to those under the double figure. If they do fit read on down, using only the characters that fit (and when they do not fit skipping to where they do) and going as far as possible when the name will be found. For instance: suppose we have a flounder with the ventral fins one on each side of the abdomen; without an arch at the front of the lateral line; the body covered with ordinary scales; the maxillary not reaching to below the hind border of the lower eye; and the pectoral fin longer than the head. We compare our specimen with 1 at the beginning of the key. The ventral fins are not as described, so we skip everything between and consult 1-1, which fits. Taking the next number below, 3, "lateral line with a high arch." It has not. We go to 3-3, which fits. The character under the next number, 8, does not fit, but under 8-8 it does. The next character below, 9, does not fit, for the maxillary does not reach to directly below the hind border of the lower eye, which character is as under 9-9. The next character, 10, fits, for the pectoral is longer than the head, and as we can go no farther it follows that our specimen is the rex sole.

The species in the body of this paper are arranged with reference to their possible relationship, but in the key their arrangement depends only upon convenience.

GLOSSARY.

Anal fin: The fin along the lower edge of the body.

Caudal fin: The tail fin.

Depth of body: The greatest distance from the base of the dorsal to the base of the anal fin.

Dorsal fin: the fin along the back.

Head: The head is measured from the tip of the snout to the edge of the gill cover.

Lateral line: A line of pore-bearing scales along the middle of the body. When the lateral line is said to have an arch in front, it means a high, abrupt arch, not simply the front of the lateral line curved up.

**Maxillary*: The flattened bone just above the mouth.

Pectoral fins (or pectorals): The fins just behind the gill openings; one on each side of the body.

Snout: That part of the head in front of the eyes.

Ventral fins (or ventrals): the pair of fins on the lower edge of the abdomen.

Families of Flat-Fishes.

The bone of the gill cover that bounds the cheek behind (preoperculum) has the margin distinct, and not covered and bound down by skin and scales. The eyes are rather large, and the mouth moderate or large, and armed with teeth. The Flounders (family *Pleuronectidae*), page 165.

The bone of the gill cover that bounds the cheek behind has the margin bound down and covered by skin and scales. The mouth is small and much twisted, and the teeth are rudimentary or absent. The only California member of this family differs from the flounders in having the body tapering to a point behind, and the dorsal, anal, and caudal fins continuous around it. The Soles (family *Soleidae*), page 179.

KEY TO THE FLOUNDERS OF CALIFORNIA.

1. Ventral fins not symmetrical; that of eyed side on ridge of abdomen.
 2. Ridge between eyes concave; highest above lower eye where it rises to a ridge. Lower eye much longer than snout. Soft Flounder (*Citharichthys sordidus*). Page 178.
 - 2-2. Ridge between eyes narrow and not concave; not highest above lower eye. Lower eye about equal to length of snout. Speckled Flounder (*Citharichthys stigmæus*). Page 178.
- 1-1. Ventral fins symmetrical. One on each side of ridge of abdomen.
 3. Lateral line with a high arch in front. (Not simply curved upwards.)
 4. Pectoral on eyed side as long or longer than the head; reaching about to middle of body. Long-finned Flounder (*Xystocurys liolepis*). Page 169.
 - 4-4. Pectoral on eyed side not much over half as long as head.
 5. Maxillary reaching to directly below hind border of lower eye, or past it.
 6. Eyes very large and separated by a high ridge of bone. Teeth very fine. Big-mouthed Flounder (*Hippoglossina stomata*). Page 168.
 - 6-6. Eyes small and separated by a flat area. Teeth sharp. Chicken Halibut (*Paralichthys californicus*).

*In the descriptions when the maxillary is said to reach to below a certain point it means vertically below. For instance: "maxillary reaching to below middle of eye" means that the fish must be held horizontally and the maxillary must reach to an imaginary line drawn vertically downward from the middle of the eye.

- 5-5. Maxillary not reaching past middle of lower eye.
 7. Depth of body about a third of the length without caudal fin. Scales fine and smooth. Halibut (*Hippoglossus hippoglossus*). Page 166.
 - 7-7. Depth of body about a half of the length without caudal fin. Scales rather large and rough. Double-lined Flounder (*Lepidopsetta bilineata*). Page 175.
- 3-3. Lateral line without a high, abrupt arch in front, but usually with a small curve.
 8. Body covered with rough, scattered plates. The dorsal and anal with alternate black and orange marks. Starry Flounder (*Platichthys stellatus*). Page 175.
- 8-8. Body covered with ordinary scales.
 9. Maxillary reaching to vertically behind the lower eye. Arrow-toothed Halibut (*Atheresthes stomias*). Page 165.
- 9-9. Maxillary not reaching to vertically below the hind border of lower eye.
 10. Pectoral fin on eyed side much longer than head. Rex Sole (*Glyptocephalus zachirus*). Page 177.
- 10-10. Pectoral fin not as long as head.
 11. Maxillary reaching to vertically below the middle of the lower eye.
 12. First dorsal rays at least twice as long as the eye, and for most of their length not connected to each other by membrane. Spotted Flounder (*Psettichthys melanostictus*). Page 168.
 - 12-12. First dorsal rays not as long as eye.
 13. Scales small; over 30 rows of them between lateral line and back at widest place. Jordan's Flounder (*Eopsetta jordani*). Page 167.
 - 13-13. Scales larger; not 20 rows of them between lateral line and back at widest place. Slender Flounder (*Lyopsetta exilis*). Page 166.
- 11-11. Maxillary not reaching to vertically below middle of lower eye.
14. Eyes not separated by high bony and spiny ridge. Dorsal beginning on ridge of body, or only slightly on the blind side.
 15. Depth of body about half of the entire length (including the caudal fin). The scales semi-imbedded and scarcely touching each other. Diamond Flounder (*Hysopsetta guttulata*). Page 173.
- 15-15. Depth of body less than half the entire length. Scales normal.
 16. Teeth on both sides of lower jaw. Scales large and rough to the touch when finger is passed towards head. Scaly-finned Flounder (*Isopsetta isolepsis*). Page 174.
- 16-16. Small blunt teeth on blind side of lower jaw only. Scales small and smooth.
 17. Ventral fins longer than long diameter of eye. The lower eye its own length from tip of snout. California Sole (*Parophrys vetulus*). Page 174.
 - 17-17. Ventral fins not over a half as long as the long diameter of the eye. The lower eye one-half its length from tip of snout. Slippery Sole (*Microstomus pacificus*). Page 177.
- 14-14. Eyes separated by a high bony ridge on which are from 1 to 3 short spines. The dorsal fin commencing on blind side of body where it curves downward with from 5 to 9 rays on the blind side.
 18. Front of dorsal at level with corner of mouth on blind side of head; at least 9 of its rays on blind side. Curl-finned Flounder (*Pleuro-nichthys decurrens*). Page 170.

- 18-18. Front of dorsal above level of corner of mouth; not more than 5 or 6 of its rays on blind side of head.
19. Ridge between eyes high and very sharp edged; ending behind in a sharp spine that stands at least one diameter of the pupil above the surrounding level of the head. Two spines on the front of the ridge, the first one extending forward to vertically above the point of the snout. Sharp-ridged Flounder (*Pleuronichthys verticalis*). Page 171.
- 19-19. Ridge between eyes not so high and sharp as described above; the front spine, if developed, behind tip of snout.
20. The bony spines at front of ridge that separate eyes scarcely developed. Mottled Flounder (*Pleuronichthys coenosus*). Page 171.
- 20-20. Two short, blunt spines developed at front of ridge that separate eyes. A dark spot usually present on the lateral line at the middle of the body, and one at each edge of the body near the base of the anal and dorsal fins towards the tail. Ritter's Flounder (*Pleuronichthys ritteri*). Page 172.

FAMILY PLEURONECTIDÆ.

The Arrow-Toothed Halibut (*Atheresthes stomias*).

This is a rather slender flounder with large scales and a big mouth armed with long sharp teeth, which are shaped like a spearhead at the point. The lateral line is without an arch in front. The space between the eyes is flat and covered with scales. The upper eye is near the edge of the head so that it shows slightly when the fish is viewed from the blind side. The maxillary is about half as long as the head, and reaches to below the hind border of the eye, or a little past.

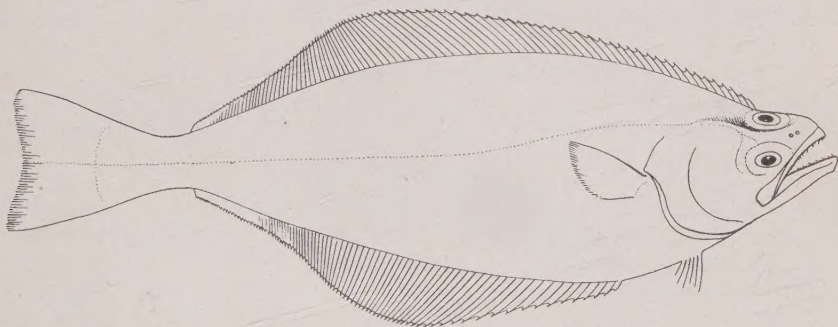


Fig. 82. The Arrow-Toothed Halibut (*Atheresthes stomias*).

This flounder reaches a length of a couple of feet, and is found in deep water off San Francisco and northward to Bering Sea. It is caught in some abundance off San Francisco in the paranzella nets and is a food fish of considerable importance, though not of the best.

The Halibut (*Hippoglossus hippoglossus*).

The halibut is a slender form with a rather thick body and a moderately large mouth. The maxillary reaches to below the middle of the lower eye. The lateral line has a high arch in front and the scales are small. The eyes are separated by a flat area.

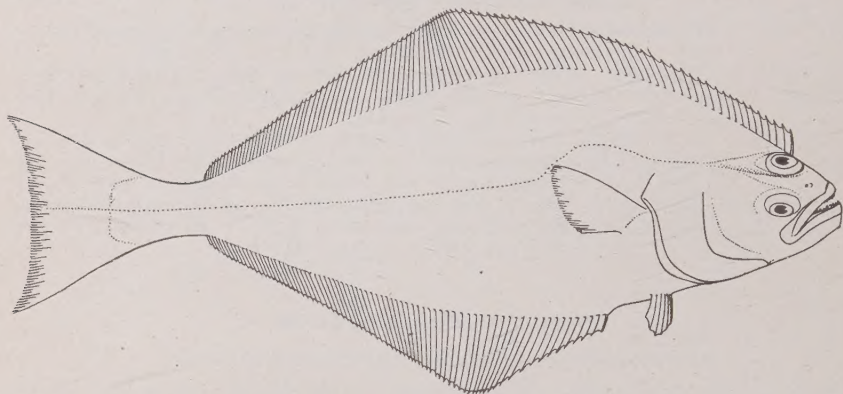


Fig. 83. The Halibut (*Hippoglossus hippoglossus*).

Both in America and Europe the halibut is the largest and most important commercially of all the flounder tribe. It reaches a weight of 500 pounds and occasionally even more. It is found on both sides of the north Atlantic and north Pacific. On our coast it is found southward to Monterey Bay. Its food appears to be anything that it may catch, including many kinds of fishes, crabs and clams.

The Slender Flounder (*Lyopsetta exilis*).

Body moderately slender, covered with rather rough, large scales. The lateral line is without an arch in front. The eyes are large and

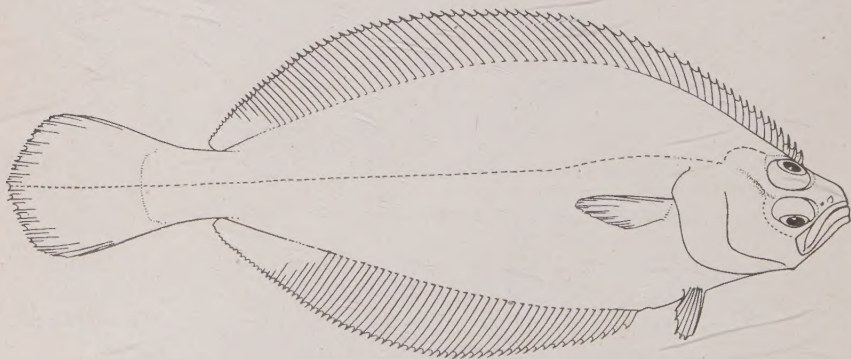


Fig. 84. The Slender Flounder (*Lyopsetta exilis*).

separated by a rather high area that is covered with fine scales. The mouth is large and curved, and the maxillary reaches to below the middle of the lower eye.

This is a small, unimportant, but abundant flounder, scarcely exceeding a foot in length. It is found from San Diego along the entire California coast and northward. The paranzella net fishermen catch it in abundance off San Francisco.

Jordans Flounder (*Eopsetta jordani*).

This flounder usually goes by the name of English sole, a name that is doubly unfortunate, for it is not a sole at all, and certainly in no way resembles the English sole. It is a moderately broad flounder with a rather large curved mouth armed with fine sharp teeth. The eyes are large, and are separated by a narrow low ridge covered with very fine scales. The maxillary reaches to below the middle of the lower eye. The length of the pectoral fin is about half that of the

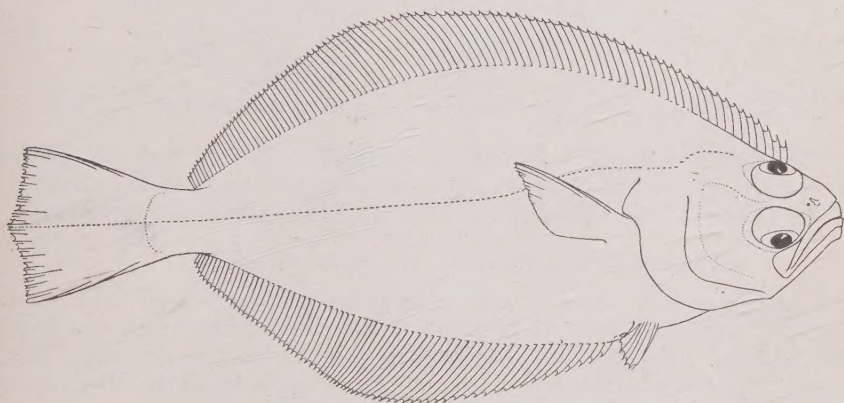


Fig. 85. Jordan's Flounder (*Eopsetta jordani*).

head. The scales are fine and rough to the touch when the finger is moved towards the head. The lateral line is without an arch at its front.

This is one of the commonest flounders on the coast of California. It is found from Monterey Bay northward to Puget Sound, and has been rarely taken as far south as San Diego. It reaches a length of 20 inches, and is one of the best food fishes among the flounders. Great numbers are dried by the Chinese.

The Spotted Flounder (*Psettichthys melanostictus*).

A rather slender flounder covered with fine scales that feel rough to the touch as the finger is moved toward the head. Fine scales cover the head and bases of the fins. The eyes are small and are separated by a rather wide, scaled area. The mouth is large and armed with long, sharp, uneven teeth. The dorsal fin begins opposite the front edge of the upper eye, and the first rays are long and slender, and connected with each other by membrane only at their base. The longest of the first rays is in length about equal to the distance from the tip of the snout to the hind margin of the upper eye. This character separates

this from any other flounder in our region. The lateral line is without an arch in front. This flounder is grayish-brown finely speckled with darker color.

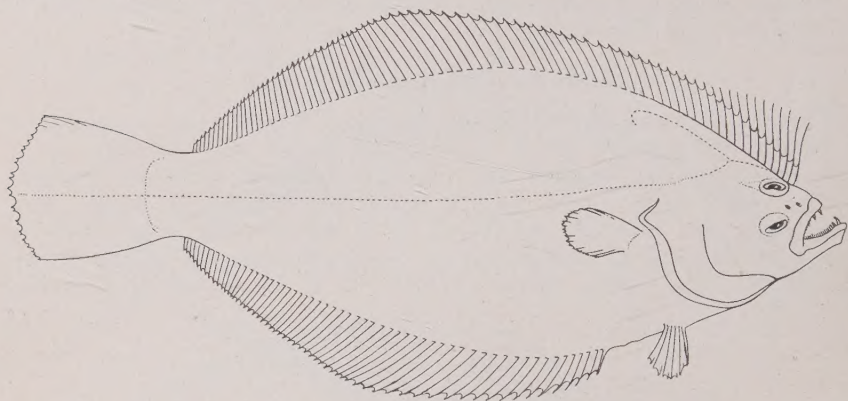


Fig. 86. The Spotted Flounder (*Psettichthys melanostictus*).

The spotted flounder is one of the common flounders, and like many others goes by the name of sole. It lives near shore and reaches a length of 20 inches. It is known from Monterey Bay northward to Alaska.

The Big-Mouth Flounder (*Hippoglossina stomata*).

A rather slender flounder with a large mouth, very small teeth, and the eyes separated by a high, sharp, bony ridge that curves upwards behind them. The front of the lateral line has an abrupt arch. The first of the two nostrils has a flap of skin just in front of which is a bony protuberance on the side of the snout. The maxillary reaches to below the hind border of the lower eye. The eyes are large and the

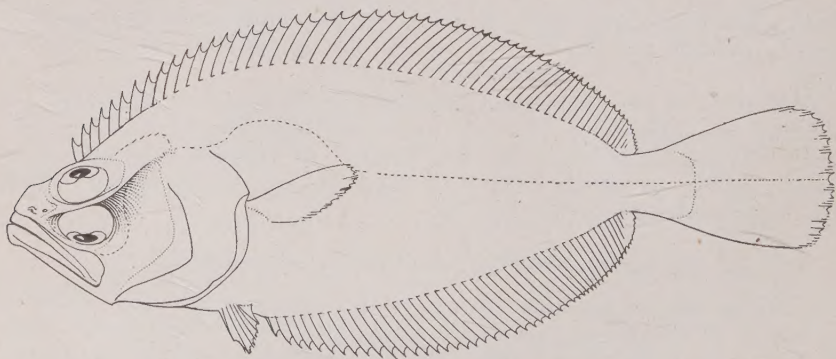


Fig. 87. The Big-Mouth Flounder (*Hippoglossina stomata*).

upper one does not nearly fill its bony socket. The dorsal begins a distance from the tip of the snout equal to the length of the pectoral of the blind side.

This is not a flounder of commercial importance, as it is rather rare. It is found off southern California and southward to the Gulf of California.

The Long-Finned Flounder (*Xystreurus liolepis*).

This is a wide flounder with an abrupt arch at the front of the lateral line, and a long pectoral fin that is as long, or longer, than the head and reaches about to the middle of the body. The mouth is moderate in size, and the maxillary reaches to below the middle of the

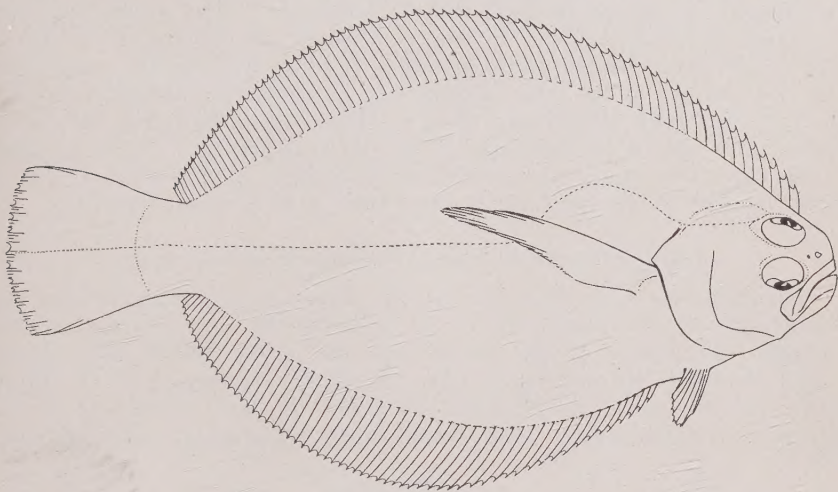


Fig. 88. The Long-Finned Flounder (*Xystreurus liolepis*).

lower eye. This flounder has the longest pectoral of any that has an arch at the front of the lateral line, though the length of the pectoral is said to vary considerably.

The long-finned flounder reaches a length of 15 inches, and is rather common on the southern California coast. It has been taken as far south as the Gulf of California.

The Chicken Halibut or Bastard Halibut (*Paralichthys californicus*).

Though this flounder is commonly known as the chicken halibut that name is more commonly used for the young of the true halibut. It is a rather slender, thick flounder, resembling somewhat the true halibut in

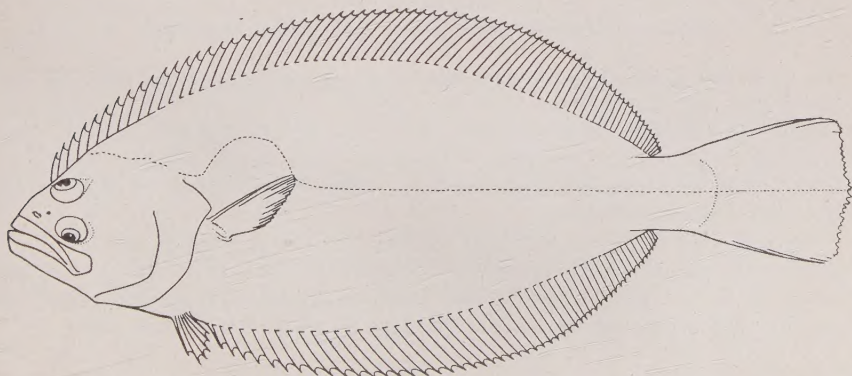


Fig. 89. The Chicken or Bastard Halibut (*Paralichthys californicus*).

shape. The front of the lateral line is arched. The eyes are small and separated by a rather wide flat area. The mouth is large and armed with large, sharp, uneven teeth. The maxillary reaches a little past the lower eye, and is about as long as the pectoral fin. The dorsal fin begins opposite the front of the eye.

This is an important food fish, being found in abundance from San Francisco southward to the Gulf of California. The young are very common in shallow water in southern bays. It reaches a length of three feet and a weight of 60 pounds. It takes its common name from its resemblance to the true halibut, and in southern California usually goes by the name of halibut. It is a rather coarse, flavorless fish, over-rated and not to be compared with the true halibut. It has found great favor with the market men on account of its good keeping qualities, and, because it has been much advertised, it is in great demand.

The Curl-Finned Flounder (*Pleuronichthys decurrens*).

This flounder may be known by the dorsal fin curling down on the blind side of the head until it is opposite the lower corner of the mouth. At least 9 of the dorsal rays are on the blind side. Three other flounders in our region have the dorsal developed on the blind side, but in them it does not extend below the level of the tip of the snout, and only about 5 rays extend down. The sharp ridge between

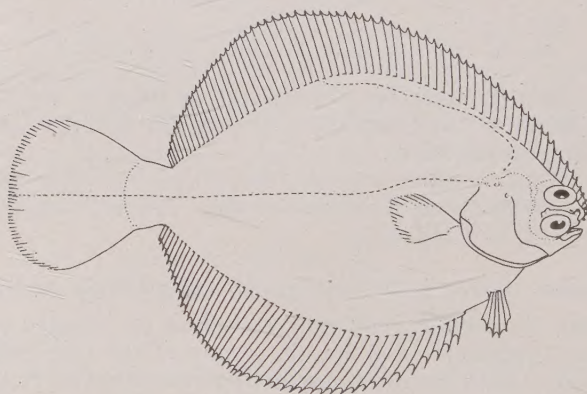


Fig. 90. The Curl-Finned Flounder (*Pleuronichthys decurrens*).

the eyes has a blunt bony protuberance opposite the hind edge of the lower eye, and another smaller one opposite the front of the upper eye. Behind the border of the upper eye there are two similar ones. The eyes are large and protruding. The scales are small, scarcely touching each other, and somewhat imbedded. There is a branch of the lateral line along the dorsal base.

This species is not uncommon in deep water, and is known from the Santa Barbara Islands northward. Many are taken in the paranzella nets. It is not recognized in the markets under a separate name but is sold with many others under the class name of flat-fish or sole.

The Sharp-Ridged Flounder (*Pleuronichthys verticalis*).

Five or six rays of the dorsal are on the blind side of the body, and the eyes are separated by a very high, sharp bony ridge that has two short sharp spines at its front, the first directly above the tip of the upper jaw and the other at the front of the eye. On the hind end of the ridge is a sharp spine, pointing backward, that stands above the surrounding level of the head a distance equal to the diameter of the pupil. There are no teeth on the eyed side of the jaws. The ventral fin of the eyed side is somewhat behind that of the blind side. The lateral line has an upper branch running back from the head along the base of the dorsal fin. The color is dark olive brown with round grayish spots. The dorsal and anal are mottled.

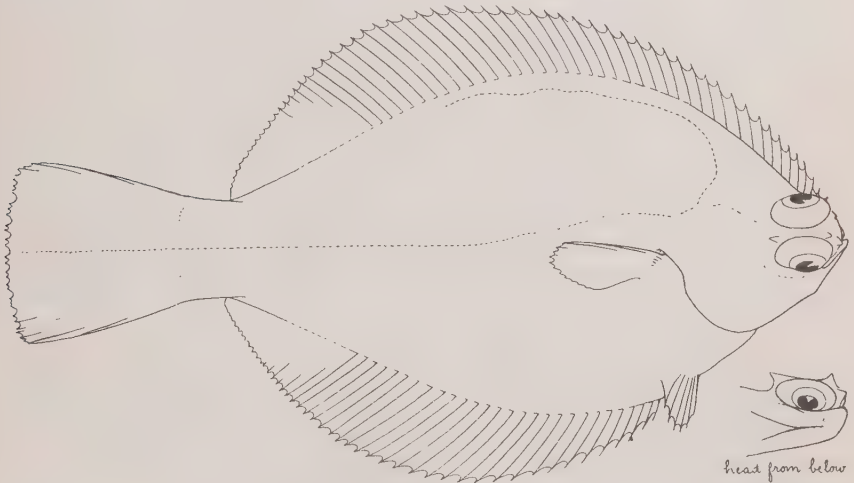


Fig. 91. The Sharp-Ridged Flounder (*Pleuronichthys verticalis*).

This species is known along the California coast southward to the Gulf of California. It is found in rather deep water. Like most of the flounders that are not caught in great abundance this is not differentiated by name by the fish men. It may be known from others that have the dorsal developed on the blind side by the character of the ridge between the eyes and the spines on it as described above.

The Mottled Flounder (*Pleuronichthys coenosus*).

Five or six rays of the dorsal fin are on the blind side of the body, and the high, sharp bony ridge that separates the eyes has no bony protuberance developed opposite the front of the eyes, but has one opposite the hind edge of the eyes that points backward and downward. There is a branch lateral line along the base of the dorsal on the front part of the body. The scales are smooth and scarcely touch each other, or at least do not overlap. The color is dark brown, usually mottled.

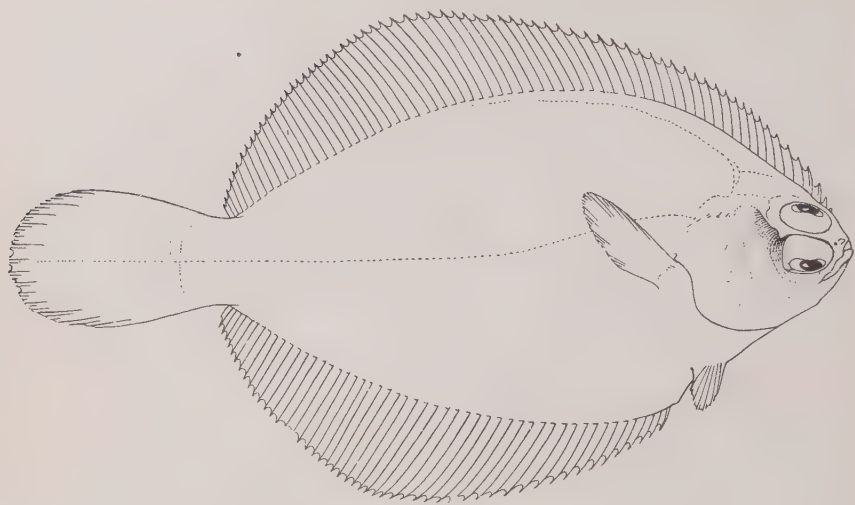


Fig. 92. The Mottled Flounder (*Pleuronichthys cocnosus*).

This flounder is rather common in water of moderate depth. It is found along the entire California coast, and grows to be about 14 inches in length.

Ritter's Flounder (*Pleuronichthys ritteri*).

About five rays of the dorsal are on the blind side of the head, the lower end of the fin being on a level with the tip of the snout. The scales overlap at least on the middle of the body, and there is a branch lateral line along the base of the dorsal fin in front. There is a small dark spot on the lateral line at about the middle of the body,

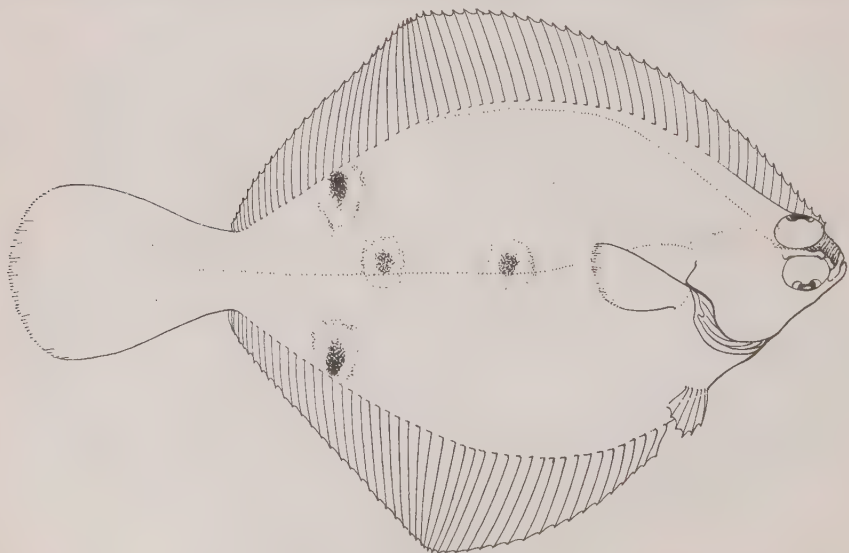


Fig. 93. Ritter's Flounder (*Pleuronichthys ritteri*).

and at each side of the body near the base of the anal and the dorsal fin towards the tail there is a similar one usually smaller. Just in front of between the last two spots there is often a fourth spot. From the sharp-ridged flounder (*P. verticalis*) and the mottled flounder (*P. coenosus*) that also have 5 rays of the dorsal on the blind side of the head this species may be known by the character of the ridge separating the eyes and the bony protuberances on it. The ridge is not so high and sharp as in *P. verticalis*, and the front bony protuberance does not overhang the tip of the snout. It has 2 bony protuberances developed at the front of the ridge, which are scarcely or not at all developed in *P. coenosus*.

This flounder is known from San Pedro southward to the coast of Lower California, where it replaces *P. coenosus* on the southern coast. It is rather abundant in San Diego Bay. It is a very good food fish and reaches a length of about a foot.

The Diamond Flounder (*Hysopsetta guttulata*).

The body is very broad and covered with smooth, semiembedded scales that scarcely touch each other. The lateral line is not arched in front, and there is a branch lateral line extending along the base of

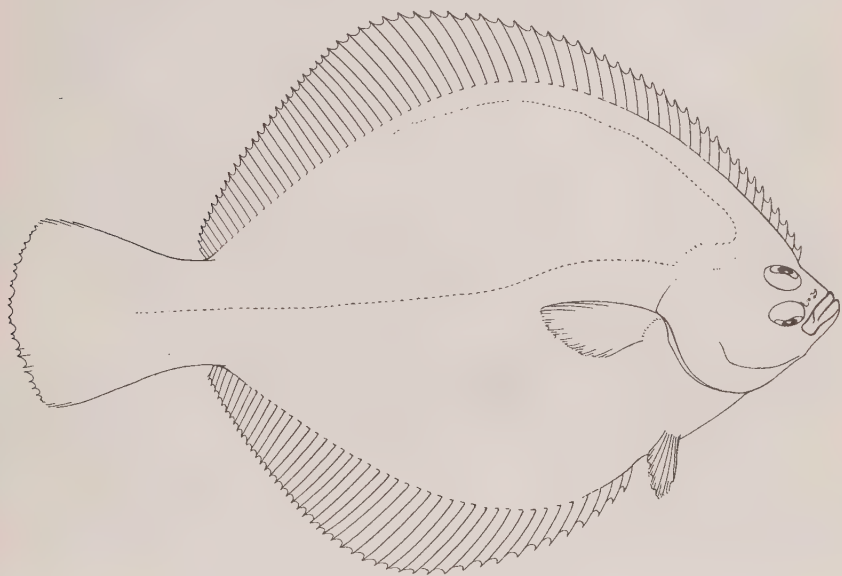


Fig. 94. The Diamond Flounder (*Hysopsetta guttulata*).

the dorsal fin in front. The mouth is small and the maxillary does not reach to below the middle of the lower eye. The outline of the head is concave just in front of the eye. On the head the scales are scarcely developed. Small teeth are on the blind side only of the jaws. The caudal fin is large and rounded.

This is a very abundant flounder south of Cape Mendocino on the California coast and is found southward along the Lower California coast. It is a very good food fish.

Common "Sole" or California "Sole" (*Parophrys vetulus*).

This flounder is moderate in width, with a concave outline of the head just above the eyes. The mouth is small, and the maxillary reaches only a little past the front of the lower eye. The eyes are large and the upper one is on the upper outline of the body, so that it may be seen slightly as the head is viewed from the blind side. There is no abrupt arch at the front of the lateral line, and a branch of the lateral line runs back from the head along the base of the front of the dorsal. The scales are fine and do not feel rough as the finger is passed towards the head. The space between the eyes is narrow, but not high and sharp.

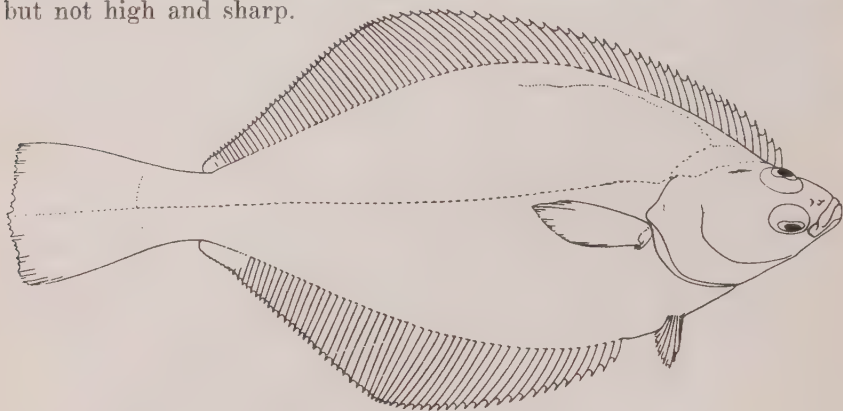


Fig. 95. The Common or California "Sole" (*Parophrys vetulus*).

This flounder in common with many others is known as a sole, and is very abundant in water of moderate depth. It is found along the entire California coast and northward to Alaska. It is small in size, but its abundance makes it of some importance.

The Scaly-Finned Flounder (*Isopsetta isolepis*).

This is a moderately wide flounder covered with rough scales which extend out on the fin rays and over the head. The front of the lateral line has a slight arch, but not a high one as in the flounders that are

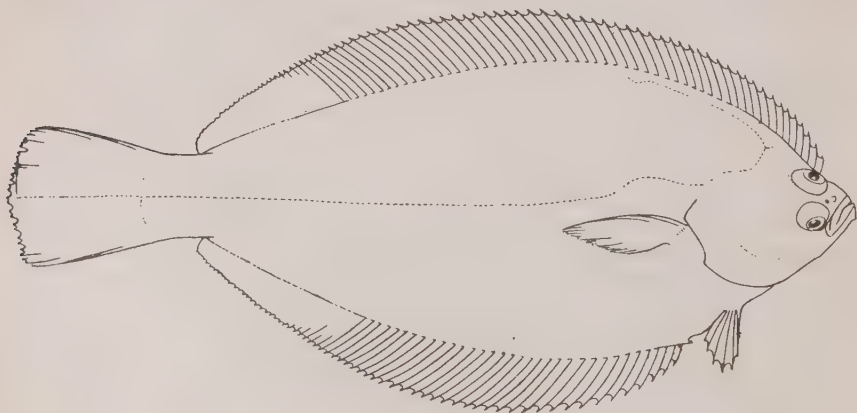


Fig. 96. The Scaly-Finned Flounder (*Isopsetta isolepis*).

here classed as having an arch at the front of the lateral line. The mouth is small and the maxillary does not reach to below the middle of the lower eye. The small eyes are separated by a moderately wide scaly space. A branch lateral line runs along the front of the base of the dorsal backwards from the head.

On the California coast this is a rather common flounder. It reaches a length of 15 inches, and is found in rather deep water from southern California northward to Puget Sound.

The Double-Lined Flounder (*Lepidopsetta bilineata*).

This is a very wide flounder, covered with scales of moderate size that are very rough in northern specimens, but in southern ones are sometimes almost entirely smooth. It has an abrupt arch at the front of the lateral line, and an accessory branch of the line follows the

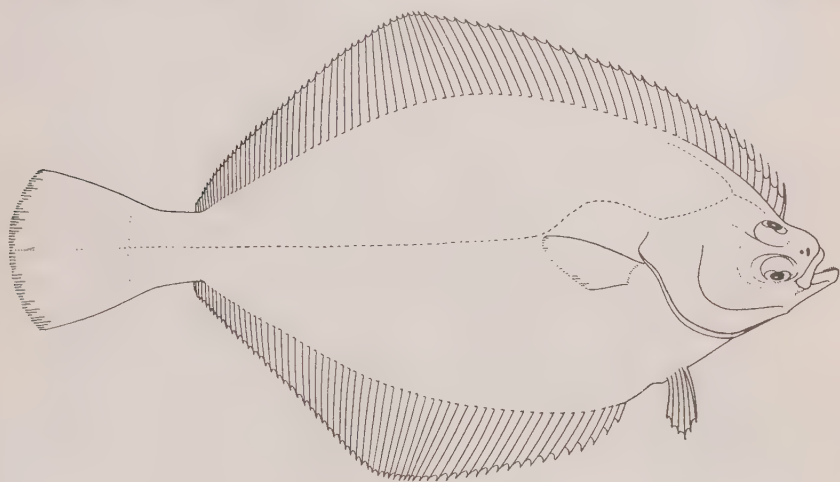


Fig. 97. The Double-Lined Flounder (*Lepidopsetta bilineata*).

base of the front of the dorsal fin. The mouth is small and the maxillary scarcely reaches to below the middle of the lower eye. The dorsal fin begins above the front of the upper eye. The eyes are moderate in size, and separated by a flat scaly area.

This is a common flounder found from southern California northward to Bering Strait, though south of Monterey Bay it is probably rare. It reaches a weight of 5 or 6 pounds.

The Starry Flounder (*Platichthys stellatus*).

This is a moderately wide flounder that may be known by the small rough plates scattered over the body, and by the alternate black and orange-brown spots or stripes on the dorsal, anal and caudal fins. The bony plates are larger and rougher at the base of the dorsal and anal fins where they are disposed in a single row. A rough ridge runs back from between the eyes, ending above the gill cover in a couple of rough bony protuberances. The lateral line is without an arch in front,

though it is rather strongly curved in this region. The mouth is small and the maxillary scarcely reaches to below the middle of the lower eye. The color is dark brown or nearly black, with spots or stripes on the dorsal, anal and caudal fins, formed by a few black rays, then a few orange or brownish ones, and thus alternating so that the stripes run lengthwise of the rays.

The starry flounder is one of our commonest flounders. It is widely distributed, being found from southern California to the Arctic Ocean,

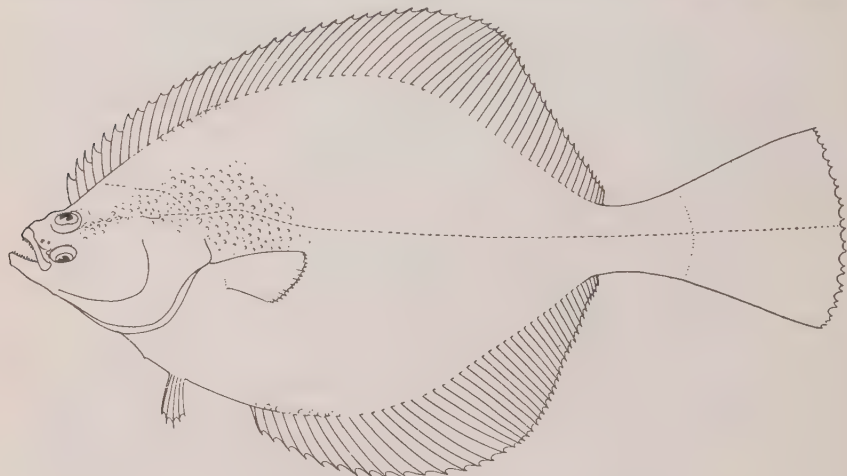


Fig. 98. The Starry Flounder (*Platichthys stellatus*).

and southward on the Asiatic side to the Amur River. It reaches a weight of 15 or 20 pounds. It lives in shallow water and sometimes ascends the larger rivers. Commercially it is one of the important flounders on account of its size and abundance, but as a table fish it is one of the poorest, being rather coarse and tasteless, and not to be compared with some of the flounders. It is almost the only flat-fish still known as a flounder, and is sometimes called "the flounder," but even it helps to form "fillet of sole."

The Slippery or Chinese "Sole" (*Microstomus pacificus*).

This is a slender flounder, covered with very fine scales. The mouth is very small, the maxillary reaching only a little past the front of the eye. The eyes are large and separated by a flat, scaly area. The teeth are developed on the blind side only of the jaw. They are broad and close set so that they form a continuous cutting edge. The gill opening does not extend above the pectoral fin. The lower eye is much longer than the snout.

The slippery sole is so called on account of the excessive mucous that covers it. On this account it is sometimes thrown back into the water by the paranzella-net men when other flounders are plentiful, for the mucous makes it difficult to hold in cleaning it. It is, however, one of the best flavored of the flounders. It does not reach a large size, being commonly taken from a foot to 18 inches in length. It is

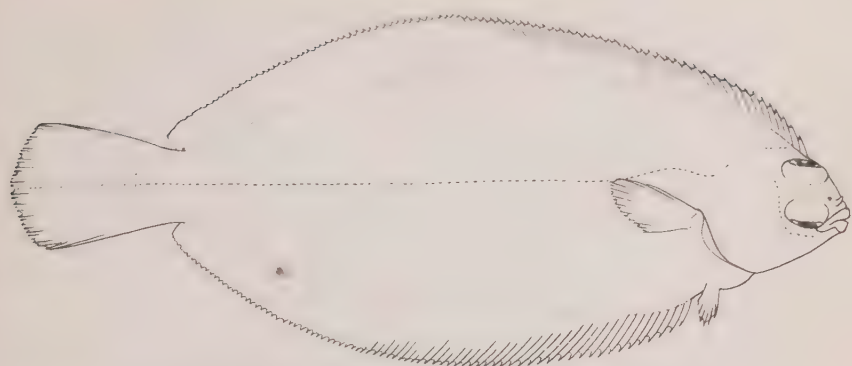


Fig. 99. The Slippery or Chinese "Sole" (*Macrostomus pacificus*).

abundant in water from 15 to 20 fathoms in depth, and is found from Puget Sound southward to southern California. South of Monterey Bay it has not been reported in abundance.

The Rex "Sole" (*Glyptocephalus zachirus*).

The rex "sole" is a slender flounder covered with smooth, fine scales. It may be known by its slender pectoral which is much longer than the head, and the lateral line without an abrupt arch in front. The mouth is very small, with the maxillary reaching past the front of the lower eye. The eyes are very large and separated by a flat narrow space that bears fine scales. The lower eye is slightly in advance. The dorsal begins above the middle of the eye. The ventrals are small, or about equal to the long diameter of the eye in length.



Fig. 100. The Rex "Sole" (*Glyptocephalus zachirus*).

This flounder is common in deep water from San Francisco northward to Bering Sea, and it has been taken as far south as southern California. It is sometimes caught in great abundance by the paranzella nets. It scarcely exceeds a foot in length. As a food fish it has been little appreciated, for it has been uncertain in its appearance in the markets. A fish that can not be counted upon to appear every day in the fish stalls, at least in its season, does not easily become a popular fish, for the caterers can not put it on a menu, and the menu is the chief source of advertising that a fish gets. It is now growing in favor, however, and bids fair to become an epicurean dish.

The Soft Flounder (*Citharichthys sordidus*).

This flounder is rather slender and is covered with large thin scales. The eyes are large, and separated by a rather wide, slightly concave space, that is highest and rises to a ridge at its lower edge just above the lower eye. The lower eye is longer than the space from it to the tip of the snout. The lateral line is without an arch in front. The mouth is moderate in size, curved, and armed with fine, sharp teeth. The maxillary reaches to below the middle of the lower eye. The dorsal begins slightly on the blind side and a little in front of the upper eye. The ventral fin of the colored side is on the ridge of the belly, and the pectoral fin is about two-thirds of the length of the head.

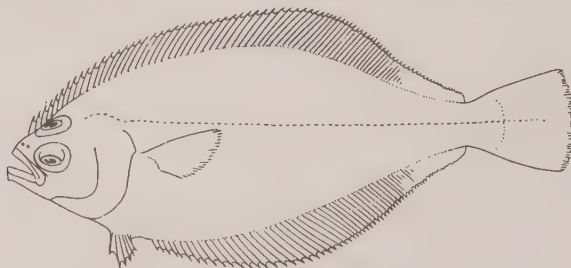


Fig. 101. The Soft Flounder (*Citharichthys sordidus*).

The soft flounder is found in considerable abundance from British Columbia to Lower California in water of moderate depth. It rarely exceeds two pounds in weight. Its flesh is rather soft and as a table fish it has not been reported upon.

Speckled Flounder (*Citharichthys stigmaeus*).

This and the soft flounder may be known by the ventral fin of the eyed side being on the ridge of the abdomen. It may be known from the soft flounder by the character of the space between the eyes, which in this species is narrow, not concave, and not rising to a ridge just above the lower eye, and by the lower eye being about equal in length

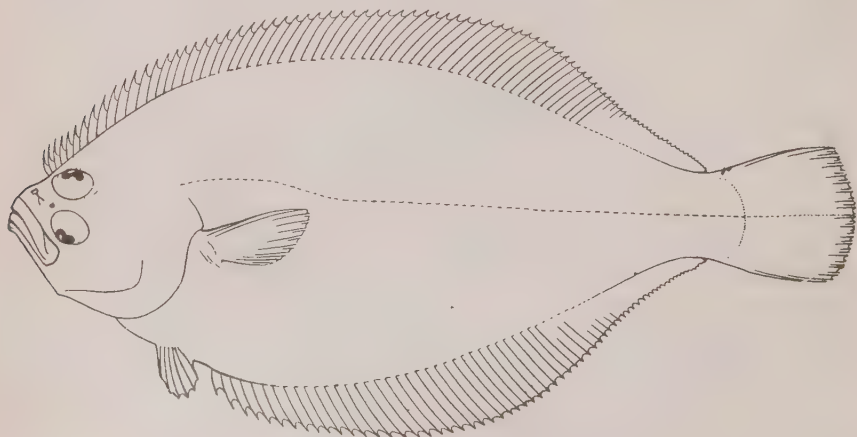


Fig. 102. The Speckled Flounder (*Citharichthys stigmaeus*).

to the space between it and the tip of the snout. The dorsal fin is rather high in front and begins somewhat on the blind side opposite the front of the eye. The lateral line is not arched in front. The maxillary reaches to below the middle of the eye.

The speckled flounder is a small rare flounder, known from San Diego to Oregon, and is found in rather deep water. Specimens have been taken that were full of spawn when at a length of only 5 inches. It is commercially of no importance whatever.

FAMILY SOLEIDÆ.

The Tongue Sole (*Symphurus atricaudus*).

This is the only true sole we have on our coast. It may be known at once from all of the other flat fishes by the shape of the body, which is blunt at the head end and tapers to a point behind as in the accompanying figure.

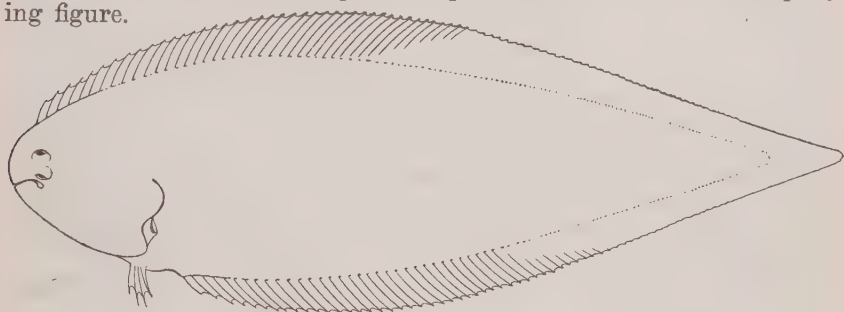


Fig. 103. The Tongue Sole (*Symphurus atricaudus*).

This sole is found from southern California southward along the lower California coast. In San Diego Bay it is rather common. On one or two occasions specimens have been taken as far northward as San Francisco. It does not exceed 6 inches in length.

ON COMMON NAMES OF FISHES.

By E. C. STARKS.

The paper on mackerel and mackerel-like fishes that appeared in the July number of CALIFORNIA FISH AND GAME has called forth considerable discussion as to the use of the names skip-jack and bonito.

It is difficult to say what is the correct use of the common name of a fish, such names not being governed by any rules, as are scientific names. A fish that is known by a certain name in one locality may bear an entirely different one in another locality; or the same name may in two localities refer to entirely different fishes; or names may be exactly reversed so that "a" becomes "b" and "b" becomes "a."

The mackerel of our coast is known on the Atlantic coast as chub, thimbleeye, and tinker, according to locality. In England it is known as the Spanish mackerel—a name I have heard applied to it in southern California. In America the name Spanish mackerel is more usually applied to a fish of the genus *Scomberomorus*. Now, no one can say which of these fishes has a better right to the name Spanish mackerel.

In America we shall continue to apply that name to members of the genus *Scomberomorus* wherever they may be found. But has it as good a right to the name as the fish called Spanish mackerel in England (our mackerel) which probably was first so called? Great numbers of examples could be quoted illustrating this confusion in the use of common names.

The name oceanic bonito has always been applied to the fish I have designated, until within recent years. In Australia, England and many Atlantic ports it has always been known as bonito. Cuvier so called it in 1831 in France, where it is still so called. In southern California, when these fishes became of commercial importance, the old names seem to have become confused. This came about when the interest was transferred from the anglers, who had a greater interest in the fishes for themselves, to the fishermen and dealers. Oceanic bonito as applied to *Euthynnus* is the best name because it is used by the greatest number of people and over the greatest part of the world; for it is a widely distributed fish. The fish called skipjack is not found in the Atlantic, though it has close relatives there. These relatives go by the name of bonito, and our representative might well be called California bonito, were it not that that name is so easily confused with oceanic bonito. This fish used to be called skipjack on our coast (a name applied to various silvery, jumping fishes in different parts of the world) and though in recent years the names skipjack and bonito seem to have been interchanged in southern California it has been restored as the best available name.

We are given to understand that the Bureau of Chemistry proposes to can *Euthynnus* under the name of striped tuna. If so, this name is to be deplored, for it is not a tuna. Not only does it belong to a different genus, but certain features of its anatomy are so strikingly different from that of the tuna that it may be placed in a different subfamily. Canning the albacore under the name of tuna has led to so much confusion that no one knows whether the albacore or the tuna is referred to when the name tuna is used.

In the papers on the fishes of California, being published, it is the intention to use the common names that are the most universally used, unless there are reasons against such use. For instance, there are very good reasons against the use of the name English sole, for the fish we call by that name is not a sole and it in no way resembles the English sole. Very often, as among the flat-fishes, there are no common names. In these cases either the meaning of the scientific name is used as a common name or some name referring to some character of the fish is used—as, spotted flounder.

Common names of fishes have been transferred from one locality to another. When our ancestors came from Europe and saw certain fishes on our Atlantic coast that had a more or less close resemblance to the fishes they were familiar with, they named them accordingly. In the same manner the common names of our Pacific fishes came from their resemblance or imagined resemblance to Atlantic fishes, and the names have been good or poor depending upon the acuteness of observation of the men who named them. Thus the names in different sections of the same coast vary according to a fancied resemblance of the fishes that bear these names to other fishes, as seen by different people.

THE SPAWNING OF THE LITTLE-SMELT, *LEURESTHES TENUIS* (AYRES).

By P. S. BARNHART, Scripps Institution for Biological Research.

We have known for a number of years that the little-smelt, *Leuresthes tenuis* (Ayres), appears in immense schools on all sandy beaches near San Diego at a certain time each year when it may be picked up from the sand in quantities. Hubbs (1916) prints a letter written to him by J. B. Joplin of Santa Ana, describing the breeding habits of this fish. Mr Joplin wrote:

"Three months during the year, usually March, April and May, on the second, third and fourth nights after the full moon, at full tide, great schools of them come out in the breakers, at the mouth and for half a mile on each side of where a small fresh water stream flows into the ocean, for the purpose of depositing their eggs or spawn in the sand. The water recedes and when the fish are not disturbed they wiggle tails down in the sand, as far out as the force of the water will carry them, both males and females—sometimes as many as eight or ten together—where the crust of the sand is broken. Sometimes only one female is found with just her head visible."

"Why they come out at night, which is usually from ten to one o'clock, and the run usually lasts three hours or longer, is a question."

"I have been observing them for thirty years and the time of their coming is so regular that during that time I have rarely missed them."

Although these facts have been known for a number of years and many people go to the beaches to gather the fish that have appeared to be cast up by the waves, so far as I know no further observations have been made of the incident and its significance. My attention was called to it a year ago when some of the fish were given to me and an examination of them showed that they were in spawning condition. It was then too late for investigation, as the last run was over, and I had to wait until this year to make these observations, which coincide in the main with the remarks in the above letter.

The nightly run begins within a few minutes of the time when the tide is at its highest point and lasts for several hours. The fish shoot in with an incoming wave, sometimes forcing themselves up the slope of the beach by wiggling and flipping until a favorable place is found, rest quietly a moment while depositing milt or eggs, begin wiggling again in the sand and finally flip back or shoot back with the next high wave that reaches them. They must have a good sense of direction for out of the immense quantity which come ashore at these times not one remains on the beach. Sometimes they half bury themselves in the sand horizontally, and I have found many of them with their bodies buried vertically right up to the pectoral fins. The greatest numbers were found in the riffles or run-offs where they crowded in and made quite a commotion. Samples of the sand taken in such places were full of

eggs. So far as I was able to observe there was no pairing of males and females.

Collections taken at different points along the beach showed that the males were in the majority by more than two to one over the females. This is directly opposite to the general condition supposed to exist among fishes. The method of spawning here described nevertheless must entail an enormous wastage of fertilizable eggs, as sometimes there are only a few seconds between the wash of the waves when the sperms and eggs are mixed in the sand by the movements of the fish and then carried off the beach by a receding wave.

The eggs are 1.8 to 2 mm. in diameter, contain a large number of reddish yellow oil drops and are demersal. In all other species of Atherinidæ so far observed the eggs are provided with delicate filaments for attachment to each other and to eel-grass and seaweeds. In this species, however, the eggs have no filaments and are entirely free from each other. The capsule is smooth and hard so that particles of sand do not adhere to it, and the egg is so heavy that it stays on or very near the bottom until hatched.

This inshore migration of *Leuresthes tenuis* has, so far as I know, only been noted on the sandy beaches between Point Loma and Newport, and are independent of the presence of freshwater streams. It would be interesting to know just how far north and south of these points it extends.

RARE FISH APPEAR OFF SOUTHERN CALIFORNIA.

By WILL F. THOMPSON.

This year has been a very unusual one in many respects in southern Californian fisheries. The albacore run has been a failure during August and very disappointing during July. The total for July of last year (1917) was probably greater than that for the whole season thus far when albacore alone is considered. The lack of albacore has to a very small extent been alleviated by the appearance in unusual numbers of other species, some formerly rare or unknown in our waters. Notable among these are the skipjack (*Euthynnus pelamis*)* and the yellowtail (*Seriola dorsalis*). Some of the canneries are taking great quantities of mackerel (*Scomber japonicus*), but the market for them appears to be sufficiently doubtful to hinder the free use of them by all firms. Among the mackerel are frequently found considerable numbers of the horse-mackerel (*Trachurus symmetricus*), which is not a true mackerel, although it is canned with them. The blue-fin, or leaping tuna (*Thunnus thynnus*) has also been taken in considerable numbers, chiefly by the purse seiners, and more especially in the earlier part of the summer. The albacore fishermen seem to obtain isolated individuals of the tuna, but not great numbers of them. Those caught by the purse seiners are fairly small, one large catch, for instance, averaging under ten pounds apiece. This contrasts greatly with the extreme weights reached of 200 or 250 pounds. It will be remembered that last year was the first year in which the purse seiners caught great numbers of

*The common name here used is the one most often given the fish in southern California. This fish is sometimes called the oceanic bonito.—Editor.

this species, one fisherman losing a part of his net due to the weight of the fish he had impounded. Altogether, the year has been thus far an unusual one indeed, contrasting greatly to the usual one in which the albacore has formed the predominating species caught at all times during its season. If it were not for the sardines, the canneries would undoubtedly have a very short year.

The impression one has of an unusual year is greatly heightened when some of the rarer forms which have been brought in are considered.

The dolphin, one of the most beautiful fish ever taken in these waters, has formed a considerable addition to the catches of the sportsmen at Catalina, and has come in to the canneries in numbers at times, despite the fact that there is no market for them there. It has been recorded from various points on the southern Californian coast by scientists in previous years. Two were caught and presented to the writer last year. It is the *Coryphæna hippurus* Linnæus of all warm seas.

The yellow-fin tuna has also been unusually abundant this year, as many as fifteen specimens having been brought in by a single fishing boat at a time. It has been much confused with the albacore and the real tuna by the fishermen and the cannerymen. The pectoral fin on the side is median in length, between that of the blue-fin tuna and that of the albacore, and the body has a strong lemon tinge everywhere, especially on the fins. It has faint reticulations below the lateral line similar to those of the young blue-fin tuna, forming indefinite stripes transverse to the body axis. In this respect it differs from the albacore, which has indefinite longitudinal arrangements of this pattern. It is commonly held to be a member of the albacore genus, rather than that of the tuna, although all three are undoubtedly so close together as to be rather members of the same genus.

Another rare fish, previously unknown in our waters, and in fact not known from Mexican waters, is the frigate mackerel (*Auxis thazard*). This has been taken in small numbers very recently, and so far as known for but a short period of time from various localities around Catalina and San Pedro. It has been described from Japan, the East Indies and the Mediterranean. It is very small and much resembles the skipjack (*Euthynnus pelamis*) save in the fact that the dorsal fins are widely separated and the colors are different, the stripes being absent and a mackerel coloration being present above the lateral line. Its appearance caused considerable excitement among the older hands at the canneries and in the markets.

HUNTING WITH BOW AND ARROW.

By SAXTON POPE.

You think it absurd when anyone tells you that he hunts with a bow and arrow.

Of course, all kids shoot with a bow and arrow, but then they never hit anything. One fellow in a sporting journal, recently said: "I never saw an archer that could scare game, much less kill any."

We think hunting with bow and arrow is not only possible, but demonstrate that it is possible by going out and getting the game.

For the past three years W. J. Compton, Arthur Young and the writer have been hunting with the long bow. We make our own weapons of Oregon yew. They are the height of a man and pull fifty to eighty pounds. The string is made of Irish linen; one strand of Bubours No. 12 for every pound of pull. This is well waxed and twisted.

The arrows used for hunting are made of birch dowels five-sixteenths or three-eighths of an inch in diameter and twenty-eight inches long.

Some arrows for shooting small game are blunt-pointed. They are

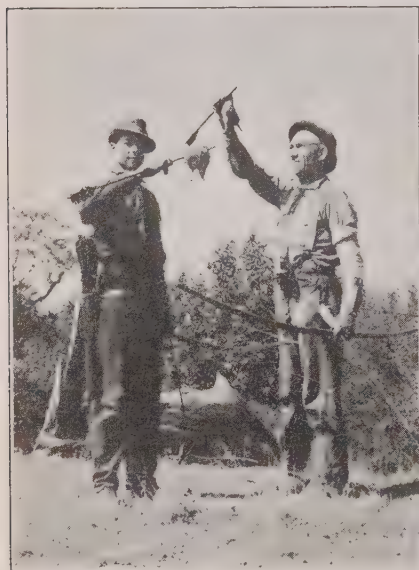


Fig. 104. Quail shot with bow and arrow by Messrs. Young and Compton at twenty yards. A bird apiece for a shot apiece. Buck killed with long bow. Photographs by Saxton Pope.

made by inserting a round headed screw in the shaft and binding the end with fine wire.

Arrows for killing large game have a steel head, shaped in the classic triangle, an inch and a half long and one inch broad. These are kept very sharp by filing them. We carry about three dozen on a hunting trip and shoot some many times.

We have hunted all sorts of game, bagging scores of quail, rabbits and squirrels. Foxes, coons, skunks and other predatory varmints have been taken into camp. These have been shot at distances ranging from ten to fifty yards.

In one afternoon Arthur Young killed seventeen ground squirrels with the bow. The last five of these animals he killed with five successive arrows.

In the line of big game, at present we have gone no further than the festive buck, but in the past three years we have killed a half dozen deer. Two years ago in Monterey County, Compton shot a running buck at 75 yards, and drove an arrow through his shoulder,

up to the feather. This deer dropped after plunging down the canyon a couple of hundred yards.

Last season Mr. Young got a three pointer at 60 yards by a shot in the flank. The deer jumped a ravine and sought shelter in a bunch of bay trees. Young landed a second arrow through the chest and put him out of commission.

On the same trip, the writer shot a forked horn at 65 yards, driving an arrow clean through him and flying twenty yards beyond. The deer ran some thirty more yards, staggered and was killed by a shot



Fig. 105. Forked-horn buck shot with long bow by Saxton Pope at sixty-five yards in Monterey County, September, 1918. The first arrow penetrated the deer completely, the second is seen sticking through the chest.

through the heart, as you see in the picture (Fig. 105). He dropped without a struggle.

An arrow in the chest, or abdominal cavity, kills as quickly as a bullet, and seems to make more hemorrhage. If it strikes muscle or bone, it makes a clean cut wound and does little damage.

Altogether, we feel that it is a clean, fair sport. It requires more careful hunting and gives the game an even chance. After all, this is the essence of sport, that there should be a contest of skill, strength and cunning between the quarry and the hunter. It is not the size of the bag that counts, it is the fairness of the contest.

Archery is difficult to master, but it is a noble and romantic art.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California State Fish and Game Commission.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

October 25, 1918.

Back of protective laws must be a healthy public sentiment, prompting every person to take the minimum rather than the maximum, and only under conditions which will permit of using all for food.—Illinois Sportsman, June 6, 1918.

ALL READERS TAKE NOTICE.

Owing to many changes of addresses it is necessary to revise our mailing list. Enclosed with this number of CALIFORNIA FISH AND GAME is a post card which everyone interested in receiving the quarterly should fill out and return promptly. Unless this card, properly filled out, is received before the next number is ready for mailing, your name will be removed from the mailing list. Those who are not interested enough to sign and send in the card are the ones we wish to eliminate from the list.

WOULD SLAUGHTER DUCKS.

During August and September the newspapers published numerous articles dealing with the destruction of rice caused by ducks. The noticeable feature of the greater part of the articles was the suggestion that the season should be opened and the ducks put on the market. Attention was focused on the sale of ducks, not on the protection of crops. Before the rice growers attempted any protective measures the Fish and Game Commission began experimenting with bombs and fireworks. As a result a simple and effective method of driving ducks from rice fields has been worked out. And this method is much less expensive.

If Congress stopped long enough during war time to pass a needed conservation measure it can not be expected that a handful of rice growers bent on slaughtering game for profit will be able to modify a law designed to benefit all the people. Practically all of the ducks coming to California during the winter season are birds which have been raised to the north of us. By international agreement we are allowed only a fair share of these ducks and fairness to the others involved demands that ducks be not slaughtered for profit.

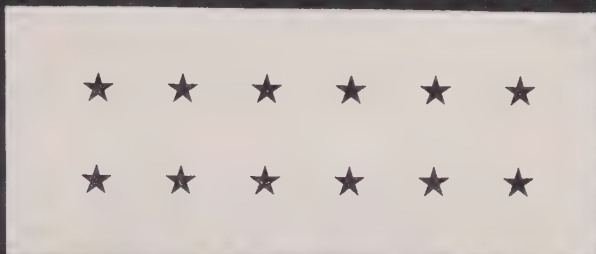
Fortunately, most rice growers realize that a means of protecting crops which will involve a small expenditure and a few men is much to be preferred over turning a bunch of market hunters into the rice fields.

BOY SCOUTS TAUGHT CONSERVATION.

This past summer most of the boy scouts in California have had an opportunity to become acquainted with the great out-of-doors in the many summer camps which have been established. Some of these camps have been in the nature of training camps of scouting, whereas others have been established as an aid to agriculturalists, the boys picking fruit or doing other agricultural work. In the training camps, each morning has been devoted to classes in scouting. The Fish and Game Commission has made it possible for many of the different camps to receive instruction in nature study and game conservation. A competent instructor has taken the boys on field excursions and taught them to recognize the different kinds of birds and animals at sight and by sound, and has given them talks on game conservation around the camp fire. Many of the boys accepted the opportunity offered and passed tests entitling them to the merit badge in conservation.

Great interest was shown at each camp where this work was instituted and many were the recruits for the army of defense formed to protect wild life. Nothing can be more fundamental in bringing about proper conservation than work of this kind.

OUR SERVICE FLAG.



E. NEILSEN
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 H. L. NEHF
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 CLAUDE CHRISTIANSON

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 R. ELKINS
 C. O. WARD

IMPORTANT PROVISIONS OF THE MIGRATORY BIRD TREATY ACT.

- Sec. 1. Title: The Migratory Bird Treaty Act.
- Sec. 2. Taking, killing, transportation or sale of migratory birds or their nests or eggs is prohibited.
- Sec. 3. The Secretary of Agriculture has power to authorize from time to time the killing or capturing of certain species or extend the season, etc. These authorizations become effective only when approved by the President.
- Sec. 4. Shipment of protected birds, eggs and nests from one state, province or territory into another, or exportation and importation is prohibited.
- Sec. 5. Violators may be arrested without warrant by an authorized agent of the Department of Agriculture and brought to trial. Birds, eggs and nests seized from such persons are confiscated and disposed of by the court.
- Sec. 6. A convicted person shall be guilty of misdemeanor and shall be fined not more than \$500 or imprisoned not more than six months, or both.

- Sec. 7. States may make additional laws for protection as they see fit.
- Sec. 8. For scientific purposes migratory birds may be killed or captured; they may also be shipped if packages are clearly marked.
- Sec. 9. Unexpended balances of money appropriations are reappropriated to be expended for expenses of carrying into effect the provisions of the act and for payment of rent, salaries, etc. Employees are not exempted from the military draft.
- Sec. 10. If any clause of the act is held invalid by a court, that shall not affect any of the other clauses.
- Sec. 11. All acts or parts of acts inconsistent with the act are repealed.
- Sec. 12. The breeding of migratory game birds on farms and preserves for purpose of increasing the food supply is permitted under proper regulations.
- Sec. 13. The act becomes effective immediately upon its passage and approval.

WHAT IS EXPECTED FROM THE NEW FEDERAL LAW.

The treaty made effective by enabling legislation for the first time provides everywhere absolute protection to migratory nongame birds, both those which are valuable to agriculture and the others which add charm to the outdoors. Secondly, it terminates forever the selfish and spendthrift attitude of certain sections of the country which, while adequately protecting their localized game,

sary permission for scientific study will be granted. Any species of birds which increase to such an extent as to be destructive to agricultural interests may be reduced in numbers by a regulation of the Secretary of Agriculture.

Already under the most unfavorable conditions splendid results are apparent in this country from the passage of the original migratory bird law in 1913. Under the beneficent influence of this regulation practically all species of birds

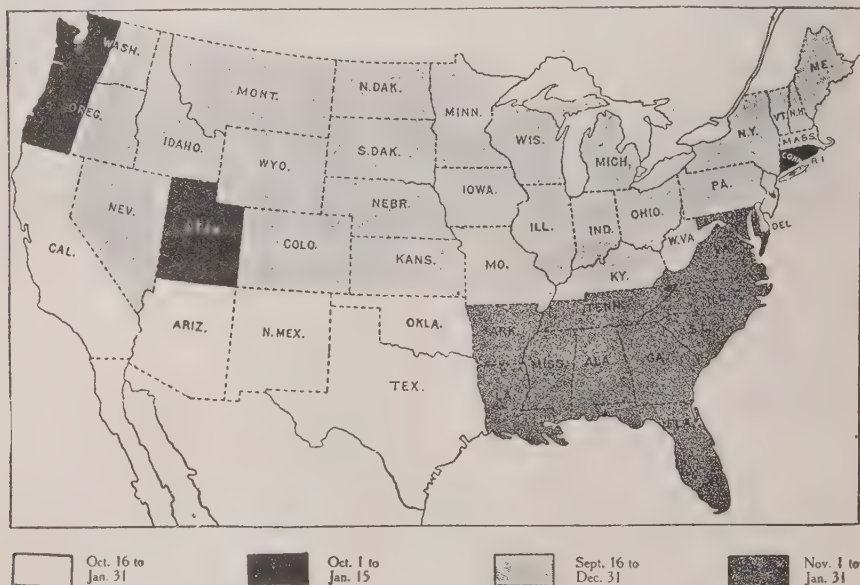


Fig. 106. Seasons under the new Migratory Bird Treaty Act Regulations, effective July 31, 1918.

exercised no forbearance whatever where the migratory game was concerned. Such sections acted on the theory that it would only be a short time before the migratory game was exterminated and that it was better to let their citizens take as much of it as they could while the supply lasted, without reference to breeding seasons or the rights of others or any economic or co-operative conditions whatever.

In addition to this, under the new law the police powers of the agents of the Department of Justice are defined and made effective. The sale of migratory game will be prohibited and suitable bag limits established. Encouragement will be given to the propagation of wild game under suitable regulations and the neces-

have increased. Waterfowl in particular have responded to the added protection to an amazing degree. Everyone is so familiar with this fact that it is needless to amplify its discussion.

As regards the game birds, it is the policy of those having to do with the regulations to equalize opportunity for all sections of the country in so far as natural conditions permit. The flexibility of the new law is another strong feature in its favor, as when any particular kind of game bird increases or decreases the open season and bag limits can be increased or decreased to suit the situation. Closed seasons can be established where game is in need of absolute protection.—
JOHN B. BURNHAM.

THE DANGERS OF THE BOUNTY SYSTEM.

Since the burden of expense of bounties for the destruction of noxious animals falls on the community at large, the question arises as to how far this method of extermination has been successful, and whether the results warrant its continuance. The value of bounties is not admitted by all, and complaints of the failure of the laws and lack of real protection are often made by those who

been expended for bounties in the United States during the last 25 years did not give results that corresponded in any way to the outlay. As regards the chance for fraud, the unequal bounties maintained on the same animals in adjoining counties or states often lead hunters to fraudulently transport the scalps to districts where a higher bounty is paid. Thus, thousands of coyote scalps were imported into California, where under the above mentioned act a bounty of \$5



Fig. 107. Boy Scouts encamped in Yosemite receiving instruction on fish and fishing. Photograph by H. R. Wilson, June, 1918.

should be most benefited by them. The most serious objections, however, are the great expense which is often out of proportion to the benefits obtained, and the chance for fraudulent misrepresentation which it affords.

As regards the expense of this method, the coyote act of our state, which went into effect March 31, 1891, and was suspended September 30, 1892, after \$187,485 had been expended and little had been accomplished, is an example of the fate which much of our recent bounty legislation has suffered. It is, therefore, safe to say that the \$3,000,000 which have

been expended for bounties in the United States during the last 25 years did not give results that corresponded in any way to the outlay. As regards the chance for fraud, the unequal bounties maintained on the same animals in adjoining counties or states often lead hunters to fraudulently transport the scalps to districts where a higher bounty is paid. Thus, thousands of coyote scalps were imported into California, where under the above mentioned act a bounty of \$5

was paid, from Nevada where only 50 cents was paid for the scalp of this animal. But there are other disadvantages inherent in the bounty system. For instance, it is often impossible to maintain bounties over the entire range of the animal that is to be exterminated. This is particularly true when the animal's range reaches into neighboring counties or states which pay no bounty and, therefore, favor their multiplication. Again, the animals to be exterminated may often be more useful than harmful. We have only recently come to realize this fact

in the case of owls, crows and other birds on which bounties were paid in several states.

Where predatory animals are a sufficiently adverse factor and not too numerous to deplete the treasury, the bounty system may be of more value. The state bounty on the mountain lion and the county bounties on coyotes during outbreaks of rabies are cases in point. This much can also be said for the bounty system: No matter what the actual result in property saved may be, it lets everyone know that something is being done, which adds greatly to the temper of the population.

The list below shows the total amounts of bounties paid in California during 1917. The estimates which had to be made in several cases are, if anything, very conservative, and it is therefore problematical whether the expense was in proportion to the damage prevented which these animals (mostly coyotes, wildcats and mountain lions) would have caused. The bounties paid by each county are also given.

BOUNTIES PAID IN 1917.

County.	
Amador	\$843 90
Butte	744 00

Calaveras	568 00
Colusa	1,447 50
Humboldt	4,224 00
Kern	90 00
Lassen	†2,000 00
Madera	1,489 50
Mendocino	4,300 00
Merced	2,404 00
Modoc	2,650 75
Mono	4,224 00
Nevada	395 00
San Joaquin	1,060 00
Santa Barbara	2,404 00
Shasta	2,240 00
Sierra	422 50
Siskiyou	*2,520 00
Solano	330 00
Sonoma	390 00
San Luis Obispo	2,687 65
Sutter	130 00
Tehama	6,030 00
Trinity	1,155 00
Tulare	*4,335 17
Tuolumne	613 00
Ventura	†1,000 00
Yolo	855 00
Yuba	1,015 00
	\$53,567 97

*Fiscal year, July 1, 1917-June 30, 1918.
†Yearly average.



Fig. 108. California Grey Squirrel (*Sciurus griseus*), a splendid game animal, the season on which opens September 1. Reproduced from a copyrighted photograph by J. F. Boysen.

BOUNTIES OFFERED ON PREDATORY ANIMALS, 1918.

County and species	Bounty	County and species	Bounty
Alameda -----	None	Nevada-----	
Alpine -----	None	Coyote -----	\$2.50
Amador-----		Orange -----	None
Bluejay -----	\$0.05	Placer -----	None
Magpies -----	.05	Plumas -----	None
Coyote -----	2.00	Riverside -----	None
Coon -----	.25	San Benito -----	None
Fox -----	.25	San Bernardino -----	None
Skunk -----	.25	San Diego -----	None
Butte-----		San Joaquin-----	
Coyote -----	3.00	Coyote -----	2.50
Calaveras-----		San Luis Obispo-----	None
Coyote -----	2.00	San Mateo -----	None
Colusa-----		Santa Barbara-----	
Coyote -----	10.00	California lion -----	20.00
Coyote pups -----	2.50	Coyote -----	2.00
Lion -----	5.00	Santa Clara -----	None
Fox -----	2.50	Santa Cruz -----	None
Buzzard -----	1.00	Sacramento -----	None
Contra Costa -----	None	Shasta-----	
Del Norte -----	None	Coyote -----	5.00
El Dorado -----	None	Sierra-----	
Fresno -----	None	California lion -----	5.00
Glenn-----		Wildcat, lynx -----	2.50
Coyote -----	5.00	Coyote -----	2.50
Humboldt-----		Siskiyou-----	
Coyote -----	8.00	Coyote -----	\$2.50
Imperial -----	None	Wildcat, lynx -----	2.50
Inyo -----	None	Lion, panther -----	30.00
Kern-----		Solano-----	
Mountain lion -----	5.00	Coyote -----	10.00
Kings-----		Sonoma-----	
Coyote -----	2.00	Coyote -----	5.00
Lake -----	None	Stanislaus-----	
Lassen -----	None	Coyote -----	2.00
Los Angeles -----	None	Sutter-----	
Madera-----		Coyote -----	10.00
Jackrabbit -----	.02½	Sheep growers also pay-----	10.00
Coyote -----	1.50	Tehama-----	
Rabbit -----	.02½	Coyote -----	5.00
Bluejay -----	.02½	Coyote pup -----	2.50
Marin-----		Wildcat -----	1.00
Coyote -----	20.00	Trinity-----	
Wildcat -----	2.50	Coyote -----	3.00
Mariposa-----		Tulare-----	
Coyote -----	1.50	Coyote -----	2.00
Wildcat -----	1.00	Tuolumne-----	
Mendocino-----		Lion -----	3.00
Coyote -----	6.00	Coyote -----	2.00
Merced-----		Wildcat, lynx -----	1.00
Coyote -----	2.00	Ventura-----	None
Modoc-----		Yolo-----	
Coyote -----	2.50	Coyote -----	20.00
Wildcat -----	1.00	Wildcat -----	2.50
Rabbit -----	.05	Yuba-----	
Mono-----		Coyote -----	5.00
Coyote -----	1.00		
Monterey -----	None		
Napa-----			
Coyote -----	2.00		
Wildcat -----	2.50		

BIRD STUDY FOR BOY SCOUTS.

In order to stimulate interest and promote the knowledge of bird life, the organization of Boy Scouts of America has been awarding a merit badge in bird study to those scouts who successfully pass a prescribed test. This test provides that the scout must, among other things, prepare a list of fifty species of wild birds, a list giving the greatest number seen in one week, and a list of twenty species valuable to agriculture. All of these must have been observed personally. He must, besides, prepare a list, from personal reading, of ten birds of prey and of ten species useful in protecting trees, and further must have been actively engaged in the protection of bird life.

This is apparently a rather difficult test for boys fourteen or sixteen years of age, for it not only requires close personal observation of bird life but some reading and practical work in conservation as well. The practical conservation work may include such things as the prevention of the slaughter of birds, the promotion of closed seasons for vanishing species, or the promotion of the establishment of bird preserves and sanctuaries.

Notwithstanding these requirements, the test was recently passed by two Oakland scouts, and will undoubtedly be passed by others in the near future.

Work of this kind among the growing generation, the focusing of attention upon the necessity for conservation at an early age, is perhaps the most effective means of producing a public opinion favorable to the protection of our birds.

MANY FISH RESCUED.

A seining crew under the direction of W. J. Green of the Sacramento Division has just completed the work of seining many young fish from Paradise Cut, San Joaquin County. The ponds consisted of land-locked holes in an area of $3\frac{1}{4}$ miles. The water in the deeper ponds will remain permanent until a new flood of water comes, so it was not necessary to remove the fish from these ponds, as they will go out with the next freshet. The most important of those species saved were:

Shad, 2" to 4" in length-----	2,500
Striped bass, 2" to 6" in length--	450

Black bass, $\frac{1}{2}$ " to 5" in length----	300
Catfish, 3" to 6" in length-----	12,000
Several species of blue-gill, sun-	
fish and crappie -----	65,000

GEORGE NEALE.

WILD PIGEONS STILL PROTECTED.

In the treaty with Canada wild pigeons, the wood duck, and the little brown and sandhill cranes, are to receive total protection for ten years. As a consequence there will be no open season on band-tailed pigeons or the other birds mentioned, despite the fact that the period of protection afforded by state law has expired.

The fact that one must read the treaty, the enabling act and the regulations to be conversant with the new federal law regarding migratory birds has led to considerable confusion.

DEER ANSWER TO BREAKFAST CALL.

Wild deer answer breakfast and dinner calls in the giant redwoods. Under the towering trees, 300 feet high and as thick as 35 feet, stands the cabin of a man who calls the bucks and does from their mountain haunts to feed. A. M. Weaver, deputy warden of the state redwood park, has succeeded after seven months' patient effort in gaining the confidence of the limpid-eyed children of the forest. The following is vouched for by Deputy J. L. Bundock of the Fish and Game Commission:

Early in the morning, or at 6 o'clock in the evening, campers and visitors hear a loud call: "Come baa-aa-by, come baa-aa-by," from the heart of the forest. Soon after this the fleet deer are seen bounding through the redwoods. They come within a few yards of the deputy warden and patiently wait until he finishes his call for others he expects, and finally throws to them cut pieces of apple. Should a stranger walk within their sight the deer wheel and bound away, returning only when Mr. Weaver calls, and after the moving person has either stopped or walked out of sight. Then they cautiously move up to Mr. Weaver and partake of his titbit offerings. Lettuce and vegetable parings form the next portion of the meal, and finally Mr. Weaver will walk toward a large

fallen redwood giant, where stands a shallow trough. The deer trot almost at his heels. Mr. Weaver spreads barley in the trough and the deer walk up to it and feed like mules.

An old doe will paw away the younger deer and feed on the thickest of the barley. They use their feet in fighting and quite often the old does seem viciously hoggish.

Last November the warden discovered the deer were following him to eat apple parings he might drop, and months of patience in accustoming them to his voice and motions have been rewarded with their answering his calls for breakfast or dinner.

The greatest number at one time that yet have answered the call is 14. Never has the call sounded with less than one coming.

During the spring the bucks dropped off, being in velvet, and Mr. Weaver does not expect them to return until their horns are hard. Does dropped off but returned within three days after finding their young. Mr. Weaver says they hide their young and come to feed, and hopes that soon the doe will bring the young in to feed with them.

Several times the deer have been driven out of the Big Basin by hounds, and several that had come to feed were lost this way, according to the warden. Deer are protected within the state park and loose dogs or firearms are prohibited.

Of those who visited the park this year, including many sportsmen, there were none who had heard of wild deer being called in to feed, and Mr. Weaver is probably the first man earning the distinction as a feeder of wild deer who can call them to their meals.

AMERICAN FISHERIES SOCIETY POINTS OUT CONSERVATION MEASURES.

At the last meeting of the American Fisheries Society, which has as members all those actively interested in fisheries conservation in this country, a Committee on Resolutions was appointed. This committee has drafted the following resolution which appeared in the March, 1918, number of the Transactions of the Society:

Report of Committee on Principles of Legislation Relative to Proper Utilization of Fisheries Resources.

WHEREAS, Under the stress of present conditions the nation has been brought to look carefully into the character and the amount of its various food supplies; and

WHEREAS, In the past it has, through lack of attention, failed to appreciate in any real sense the significance of its food fishes and the opportunities afforded by its numerous and varied water bodies to produce a large and important element for the food supply of the nation; and

WHEREAS, We, members of the American Fisheries Society, in session at the Forty-seventh Annual Meeting held at St. Paul, Minnesota, by virtue of our contact with the fishing industry and knowledge of its problems and opportunities, being thus aware of the dangers in the situation and cognizant of the various lines in which the nation can be benefited at the present time, desire to record in formal manner those fundamental principles which appear to be essential to wise legislation and to effective work for the proper utilization of the fishing resources of the nation, and do accordingly express these views; and

WHEREAS, Under the stress of war conditions expert advice and trained supervision is even more necessary than in ordinary times; and

WHEREAS, Hasty or inexperienced action may easily result in the depletion of natural resources which can not be restored within a long period of years; and

WHEREAS, In the staff of the United States Bureau of Fisheries, and in the trained experts of the state bureaus, commissions and hatcheries, the country is possessed of a body of highly trained men devoted to the needs of the nation as a whole and qualified to speak on special problems of fisheries in the war with the knowledge and experience that will guard against the evident danger of hasty action; and

WHEREAS, Proposals have been made to suspend or revoke laws for the regulation of fisheries which have grown out of long experience and careful study of conditions regarding the habits, growth and multiplication of fish on the one hand, and the practical conditions of the fishing industries on the other hand; and

WHEREAS, The shad, striped bass, and other anadromous species have decreased in some rivers almost to the point of extinction, because of fishing devices operated in the salt and brackish waters through which they must pass to reach their natural spawning grounds in fresh water; and

WHEREAS, Artificial propagation of these species is impossible and natural reproduction is prevented unless a reasonable supply of such fishes is allowed to reach their natural spawning grounds in fresh waters; therefore be it

Resolved. That the expression "letting down the bars," as applied to the fishery resources of the country, is unfortunate; national welfare demands the greatest development of the said fisheries, including fish culture and the artificial propagation of food fishes to the highest possible point of efficiency;

Resolved. That commercialization of the so-called game fishes is not conducive to their proper conservation, but would tend to destroy a limited but valuable food product—the annual catch under present restrictive laws, aided by artificial propagation, being barely sufficient to maintain a reasonable annual supply;

Resolved. That the taking of nongame fishes, under proper supervision, be en-

trol of all anadromous fishes; and be it further

Resolved. That a copy of these resolutions be forwarded to the Bureau of Fisheries, the United States Food Administration, and the fisheries authorities of the various states.

(Signed) JOHN W. TITCOMB,
Chairman.

GAME CONDITIONS IN ALPINE COUNTY.

Hunting and fishing in Alpine County was exceptionally good this year. Not for fifteen years has there been such an abundance of game in that district as



Fig. 109. A good day's kill, 3 wildcats and 1 mountain lion, made by Jay C. Bruce, February 14, 1918, at Wawona, California. This kill represented \$53 in cash in addition to the sport.

couraged in every legitimate manner consistent with the preservation of a sufficient breeding stock to insure a future normal crop (in states where required, necessary legislation to this end should be enacted); that many waters in which the so-called game fishes predominate contain also rough fish such as carp, suckers, bowfin, gars, etc., and in such waters the removal of these nongame fishes will be beneficial to angling, and a limited amount of commercial fishing, under proper regulation, should be encouraged;

Resolved. That the anadromous fishes should be permitted to ascend the rivers from the ocean in sufficient numbers to maintain a constant and normal supply, and that to this extent the commercial fishing should be subject to proper regulation; and be it

Resolved. That a solution of this problem relating to the alarming decrease of these species rests in the federal con-

there was this season. I obtained my limit of deer during the first two days—all mule-tail deer and every one a big fellow. This abundance of game is undoubtedly due to the spike-buck law, which is one of the best laws ever put into effect. Mountain quail and grouse seem to be double the number that they have been in previous years, and this is perhaps due to the lack of hunters on account of the war.

At Highland Lakes, the largest one being the headwater of the Mokelumne River and the smaller one the headwater of the Stanislaus River, the fishing is unequalled. Cutthroat, Loch Leven and Dolly Varden trout from 1½ to 5 pounds are numerous.

The outlet to the large lake is the spawning grounds for the cutthroats, but this summer it dried up, leaving the spawn in little pools. Several other fellows and myself caught about fifteen horse buckets full and distributed them in the lake and farther on down the stream, to save them from dying.

ASA M. CLARK.

FINE FOR KILLING PIGEONS.

The fact that a great many pigeons of the racing homer type, which have been trained by the Signal Corps of the Army for purposes of communication, are destroyed by hunters and children, has led to the passage of an act by Congress prohibiting the killing or capture of these birds and providing a fine of \$100 and imprisonment. Carrier pigeons are an effective means of communication in the Army, and any pigeon in the air may therefore be "in the service." Consequently it is necessary that they be allowed to proceed on their way unmolested, for interference with them may prevent the delivery of an important message, or at least interrupt their training. The Fish and Game Commission has recently, through its deputies, given publicity to the above facts, and it is expected that the co-operation of hunters thus induced will insure greater safety to the birds.

FISH LAWS AGAIN MODIFIED.

The United States Food Administration has made the following modifications in the state fish laws, and these are now in effect:

Black bass, crappie, Sacramento perch and sunfish may be taken with hook and line in the state of California during the month of April. Otherwise the daily limit and prohibition of sale shall remain as in the present state law.

Market fish may be taken in Tulare Lake with nets under the supervision of the Fish and Game Commission.

Three-mesh or trammel nets or nets with strings or suspenders, provided the nets are not of less than five and one-half inch mesh, may be used in that part of Fish and Game District No. 12B, lying northeasterly above Vallejo Light.

Shrimp trawls may be used for the purpose of taking shrimps only in the waters designated in the state laws as Fish and Game District No. 12, but any person or firm desiring to use a shrimp trawl must first notify the Fish and Game Commission of his intention so to do. Unmarketable shrimps taken while fish-

ing for the fresh shrimp market may be dried and sold for food within the state of California. In the catching of shrimps, the line dividing what are designated as Fish and Game District No. 12 and No. 13 shall be considered as extending from Point Avisadero to the end of the Alameda Mole.

Gill nets may be used for catching smelt and herring in Elkhorn Slough, Monterey County.

California whiting, also known as corbina or surf fish, yellow-fin croaker, and spot-fin croaker, the sale of which is now prohibited by the state law, may, until further notice, be sold.

Paranzella nets, trawls or drag-nets shall not be used or dragged within the three-mile limit of District No. 19, under penalty of having the federal license revoked. It will be lawful to carry paranzella nets, trawls or drag-nets across the waters of the three-mile limit within District No. 19.

Bait nets may be used in Fish and Game District No. 20 (Santa Catalina Island) for the purpose of taking bait only.

Salt-water perch south of Point Concepcion, when caught incident to catching other fish, may be shipped and sold.

Beach seining is unlawful, except for seining for smelt in District No. 19 during the open season for smelt; *i. e.*, the first day of September to the thirty-first day of January.

Halibut below the four-pound minimum weight prescribed by the state law, may hereafter be sold, provided they are caught in conformity with the laws of this state as modified above.

Barracuda between eighteen inches in length and three pounds in weight, caught incident to catching other fish, may be sold.

FISH PROTECTIVE ASSOCIATION FORMED.

At the annual meeting of The Salt Water Fish Protective Association of Southern California, held in the city hall, Avalon, California, in June, 1918, the following officers were duly elected by unanimous vote: President, J. H. Stamford; First Vice President, James L. Trout; Second Vice President, B. Wynns; Secretary, Ernest Windle; Treasurer, F. W. Elder, with the following members to make up the Executive Committee: C. B. Parker, P. V. Reyes, H. D. MacRae. A motion was duly made and carried to make the membership dues of the association for the coming year as follows: Associate members \$1, Active \$2, Life \$10, Benefactor \$100. The association adopted for its 1918 motto, "For the improvement of conditions affecting spawning fish."

GAME SANCTUARIES IN PENNSYLVANIA.

The game preserves in Pennsylvania are each one about nine miles in circumference and inclose about 3,200 acres each. A tract of this size is large enough to provide safety for the game and not too large to permit animals to breed and live and die in them without benefiting anyone. They are surrounded by an open space from ten to fifteen feet in width, from which the underbrush has been cut. This is known as a fire-line,

but comes and goes at pleasure. No dog is permitted on these lands at any time.

Each preserve is under the supervision of a keeper, who lives in a house erected for his use. He has a stable, a horse, and suitable fire apparatus. During the open season he travels around the sanctuary at least once each day. During the closed season he goes around as necessity may require.

It is the duty of this keeper to protect and feed game in the preserve, to kill vermin, and to see to it that any animal



Fig. 110. Bear Lake Hatchery, San Bernardino Mountains. This hatchery furnishes fish for restocking the most famous of the fishing grounds in southern California. Photograph by Barry, April, 1918.

because forest fires can easily be extinguished by going along this line. On the inner side of the fire-line is stretched, about waist high, a strand of wire as thick as a telegraph wire, to mark the boundaries of this fixed area, and to give notice that it is more than an ordinary tract of land.

Along the wire at intervals of a hundred yards or so are posted notices, printed on cloth, calling attention to the fact that the wire encloses a state game preserve, upon which no hunting by any person is permitted at any time, and asking those who read to keep out and help to keep others out. Game is not enclosed,

mortally wounded by hunters during the open season is captured and delivered to the men who first wounded the animal. The hunter, following his wounded quarry, finding it has gone under the wire, immediately reports that fact to the keeper, who, if he finds the game mortally hurt, kills it and delivers it to the hunter to whom it belongs.

AEROPLANE OBSERVATIONS OF MIGRATING BIRDS.

Despite the strenuous and engrossing character of their occupation, a few aviators have found opportunity to note the height of flight of various migrating birds.

Thus, from French soldiers of the air, it is learned that swallows have been observed to maintain an average altitude of 700 yards and wild ducks one of 1,800 yards, while green plover have been seen at a height of 2,150 yards. Incidentally it may be mentioned that the ducks were moving at a speed of $65\frac{1}{2}$ miles an hour when flying upward and 69 miles an hour when flying horizontally. From another aviator it is learned that when he was flying at 9,500 feet he saw swallows

(1) A series of national game preserves located in favorable situations and distributed in National Forests throughout the West in order to provide breeding sanctuaries where game may increase and supply the surrounding areas.

(2) Co-operation between the Forest Service and the states wherein National Forests are located, whereby the Forest Service shall designate the parts of the forests where hunting may be done and the number of animals that may be killed



Fig 111. Truck No. 2 at Mt. Whitney Hatchery. By means of two trucks such as this the output of the Mt. Whitney Hatchery is hauled to the railroad station. Photograph by A. E. Culver, 1918.

high above him. And another, whose observations were made at a height of 6,000 feet during a heavy bombardment, "with anti-aircraft shells bursting in all directions," states that he observed 200 golden plover, perhaps driven higher than usual by the fact that the vicinity was "an unpleasant belt to cross."—Current Items of Interest, Feb. 21, 1918.

THREE ESSENTIALS IN BIG GAME CONSERVATION.

In a program for rehabilitating the game resources of the National Forests, where there is abundant room for an enormous number of game animals without seriously interfering with the present livestock industry, three things are essential:

in any particular forest or section of forest each season, the states meanwhile to have full control over issuing hunting licenses and to receive all fees therefrom. The states would thus benefit by the services of the trained force of forest rangers and guardians acting as federal game wardens to guard the game resources from spoliation just as they now protect the trees and the grazing in the interest of the country at large.

(3) A co-operative arrangement between the Forest Service and the National Park Service whereby the game service in the National Parks and the National Monuments shall be co-ordinated with that of the Forest Service to the same end, that the game supply may be increased and perpetuated.—E. W. NELSON, in *Recreation*, November, 1917.

DISTRIBUTION OF GAME BIRDS IN GERMANY.

According to present food regulations in Germany, a small number of the game birds killed by hunters go to the owners of the preserves on which they are taken, and the rest of the bag is divided into two equal parts, one for the local supply, the other for the cities. In Bavaria, four

out of every five of all pheasants and partridges killed after the first five, must be delivered to the commune. Maximum prices are fixed for partridges and wild ducks. No report has come to hand of any relaxation of the laws protecting nongame birds so as to permit their utilization as food.—Current Items of Interest, June 29, 1918.

FACTS OF CURRENT INTEREST.

The Gates and the Harvester ranches near Corcoran, Kings County, which reported heavy damage by geese in February now report the heaviest grain crop ever harvested in the vicinity.



Large catches of salmon were made on the Sacramento River during the middle of September.



Catalina anglers had taken 600 tuna and 19 marlin-spike fish up to August 27, 1918. The deep sea angling of Santa Catalina Island attracts sportsmen from all over the world.



The tuna catch in southern California has been much below normal. The last of August the fish disappeared entirely and canneries had to turn their attention to yellowtail and other fish.



By September 5, sixty-one sportsmen of Sacramento had returned with deer. About ten of this number had secured the limit.



Some aliens are enthusiastic anglers. A Japanese in Sacramento recently sold twelve books of anglers' licenses to his countrymen.



Experiments have proved conclusively that ducks can be successfully frightened from rice fields by bombs.



The new federal regulations providing for the opening of the dove season on September 1 disturbed many dove hunters in District 1, where the season opened August 1, but many young birds will be spared as a result.



The drying up of many overflowed areas and many irrigation canals has necessitated the rescue of many fish in the Sacramento and San Joaquin valleys.

COMMERCIAL FISHERY NOTES.

N. B. SCOFIELD, Editor.

INSHORE TRAWL FISHING NOT TO BE ALLOWED.

Recently fishermen operating the smaller seine trawls in Scotland asked the Fisheries Board for the privilege of fishing within the restricted districts within the three-mile limit. As far as we can learn this privilege has not been granted. The seine trawls of Scotland are a relic of the days when all of the fishing was done in shallow water close to shore, before the adoption of the beam trawl and later of the otter trawl.

Extensive investigations by the Scotland Fisheries Board into the effects of trawl net fishing resulted in prohibiting the use of these nets in shallow water within the three-mile limit, for the reason that the young fish congregate in the shallow water near the shore and their destruction and consequent waste by the operation of these nets was too great. Despite the fact that many of the varieties of fish in the North Sea have been depleted and the larger trawlers now go as far as Iceland for their fish, and despite the fact that Scotland and England have been engaged actively in the Great War for four years and meats have become scarce, and the price paid fishermen for trawl-caught fish has reached the government's maximum control price of 18 cents per pound, the trawls are still prohibited from fishing in the water near shore. England and Scotland in conserving their fisheries plan to regulate the fishing so that they will get the greatest perpetual output and they will not consent to the excessive destruction of fish before they have reached maturity. The destruction of young fish is bad enough in the deeper water and the trawls will not be allowed in the shallow water except as a last resort.

In California our trawl fishing is done in the most part by the primitive seine trawl, or paranzella, as it is called in northern California, and the drag-net, as it is known in southern California. For six years now these nets have been barred from the inshore districts within the three-mile limit along portions of the coast for the reason that here, as in the

North Sea, they destroy too many immature fish close inshore.

Let us compare the conditions here with those in England and Scotland. Outside the three-mile limit in the neighborhood of San Francisco trawler fish are more numerous on each acre of bottom than they are in the waters surrounding England and Scotland. We have been at war little over a year and there is not a shortage of meat in California. We have an abundance of good varieties of fish, which, for lack of a market, are not caught. We utilize less than 10 per cent of the fish that are caught, the rest being canned or cured for export. No shortage in fish is indicated by prices, for the retail price of trawler fish here is only about half the price received by the fishermen in England. If we knew the retail price of these fish in England the price of our fish would appear ridiculously small. As stated above, England and Scotland have not deemed it necessary to set aside their conservation measures. We are different in America. We exploit our natural resources as though they were without limit, using destructive methods and taking little thought of the future.

Trawler fish during most of the year in California are caught in excess of the demand and large quantities are disposed of at reduction plants. Occasionally there are times when our primitive trawlers fail to make good catches for the reason that they actually fish only three hours out of twenty-four. On account of their lack of room aboard to clean and ice the fish or to house the crew they venture only a little way from port and have to return each evening. They also are unable to fish in deeper water than sixty fathoms. In spite of their poor equipment and their three hours of actual fishing a day, they manage to catch more fish during most of the year than the people will eat. Without proper facilities for caring for the fish they catch, or for holding their big catches over to dispose of during the time of poor catches, they occasionally fail to supply the market. Then the cry immediately goes up

that the restrictive laws are to blame and that they should be allowed to work inshore in the shallow water, even using the worn-out argument that they destroy fewer small fish in the shallow than in the deep water, never seeming to realize that their poor methods and poor equipment are to blame.

TINKER MACKEREL.

Excerpt from the New York Fishing Gazette of August 17, 1918:

"Probably the highest price ever paid for tinker mackerel at Portland, Me., was that given boat fishermen recently by the Rundlett Company, they paying 27 cents a pound right out of the boats. For the past two weeks mackerel have been unusually scarce all along the New England coast, few being found by the seiners, while the traps on the Maine coast have of late collected only small amounts."

This item should be of interest to Californians, for we have large numbers of tinker mackerel in our coast waters from Monterey to San Diego. Ours is in every way as good as the Atlantic fish, but is neglected at 10 cents per pound retail and the price to the fishermen seldom exceeds three cents. Not long ago there was what was styled a "fish famine" in southern California at a time when great schools of these excellent fish were all along the coast feeding close to the shore where anyone could catch them. When fishermen were asked why they did not catch them they replied that there was no market for them.

SCOTLAND'S FISHERY PRODUCTS.

The Annual Report of the Fishery Board of Scotland, recently published, states that the total quantity of fish, including shellfish, landed in Scotland in 1917 was 344,934,016 pounds, valued at \$18,029,355. This is a decrease of 10 per cent compared with 1916, but an increase in value of 16 per cent; 4,609 fishing vessels were employed, manned by crews numbering 14,800.

ENGLISH FISHERMEN GET HIGH PRICES.

Steam trawlers in the northeastern fishing district of England landed at Grimsby and Hull, for the quarter ending June 30, 1918, a little less than

65,000,000 pounds of wet fish, which was worth to the fishermen 18 cents per pound. This is an increase over the corresponding quarter in 1917 both in quantity and price paid. The fish sold at the maximum government control prices. Other trawlers several times realized over \$14,600 per trip and in one instance one trawler sold its catch for a single trip for \$53,044.

CANADA EXPORTS NINETY-FIVE PER CENT OF CATCH.

According to a statement issued by the Canadian Government, the Canadians do not eat enough fish. Out of 200,000,000 pounds of cod caught each year, the people of Canada eat less than 5 per cent, the rest being cured for export. The government is making great efforts to induce the people to use more fish, as they are short of meats.

SOCKEYE SALMON RUN BEING RE-ESTABLISHED IN THE COLUMBIA RIVER.

Years ago there was a good run of sockeye salmon in the Columbia River, but due to excessive fishing on the lower river and to the use of traps and spears for capturing the fish after they had reached their spawning grounds in the upper tributaries, the run was all but wiped out. In fact, the run was so depleted that a sufficient number could at no place be taken to warrant establishing a hatchery.

Eight years ago the U. S. Bureau of Fisheries conceived the idea of bringing sockeye eggs from their Yes Bay station in Alaska to be hatched and liberated in the Columbia. The eggs were sent to the Oregon Fish and Game Commission and hatched at the State Hatchery at Bonneville. Unfortunately, the young fish were not held a sufficiently long time after hatching and it is doubtful if any result was obtained during the first few years of the operations.

In the meantime, it was shown by the researches of Dr. C. H. Gilbert of Stanford University, that the young sockeyes naturally spend from one to three of the first years of their life in the lakes and that of the small proportion that pass to sea shortly after hatching, few or none live to return again to the stream. Four years

ago, acting on this knowledge, several hundred thousand out of nearly two million young fish hatched, were retained and fed in one of the ponds at Bonneville Hatchery until the spring of 1916, at which time they were a little over one year of age. Under the direction of Dr. C. H. Gilbert fifty thousand of these sockeyes were marked by removing the adipose and both ventral fins. The marked fish as well as the rest which had been held in the pond were liberated in the spring of 1916.

The majority of the Yes Bay sockeyes mature in their fifth year, but a slightly smaller number mature and return to their parent stream in their fourth year. As these marked salmon were four years old this year a lookout was kept for their return with the result that numerous marked fish have been found from Astoria to The Dalles. As high as ten specimens were received at one cannery in a day. As is usual in such cases, all of the salmon receiving stations did not look carefully for the marked fish or keep a proper record of those which were observed, but from the number of marked fish observed by certain canneries it is estimated that fully 2,000 marked fish were taken on the river, which is 1 per cent of the number marked. This is a conservative estimate of the number of marked fish which were captured and

does not take into account the marked fish which returned, but were not captured.

It is also pointed out that more marked fish can be expected to return next year for a majority of the Yes Bay sockeyes mature at five years and a large proportion of the native Columbia sockeyes mature at five years.

An interesting and very important fact in connection with this experiment is that these Yes Bay salmon averaged $6\frac{1}{2}$ pounds weight while the Columbia sockeyes, or "Bluebacks" as they are called, average about $3\frac{1}{2}$ pounds, thus indicating that by properly selecting the breeding stock much larger fish can be produced in the same length of time, greatly increasing the output of the river without correspondingly increasing the expense of the hatchery operations.

But, of far greater importance is the large per cent of returned marked fish, good evidence which so far has been lacking, that intelligent artificial propagation of sockeye salmon pays. If in nature one sockeye egg out of each thousand would hatch and the resulting fish reach maturity, and return to the parent stream to spawn, the run would hold its own even if one-half the returning fish were captured by fishermen.

Bearing this in mind, the gain of getting back 4 per cent, or 40 out of each 1,000 of the fish, becomes more apparent.

LIFE HISTORY NOTES.

RING-NECKED PHEASANTS IN SANTA CLARA COUNTY.

Ring-necked pheasants (*Phasianus torquatus*) have been doing well in the Santa Clara Valley, especially so on the freshwater marshes or lowlands. However, the fact that alfalfa fields, and the fields in which volunteer hay is raised, form favorite nesting places constitutes a serious menace to the birds, for large numbers of eggs and young are destroyed by mowing machines. The birds are laying and nesting just about the time hay is being mowed. The hen sits very close and does not leave or fly from the nest until the mowing machine is right on top of her, very often too late to save the eggs or young chicks, and quite fre-

quently too late to save herself from being killed.

Last season in the Ogier field, containing about 100 acres, while the first crop of alfalfa hay was being cut, over 100 eggs, about 25 young pheasants and three pheasant hens were destroyed and killed. In the Billings field on the Coffin Road, near the Mountain View Road, four nests containing about 60 eggs and one hatch of about 14 young birds were saved. During this season (1918), on this place, not one egg or bird was lost; but last season not a single one was saved, although Mr. Johnson, who drove the mower both seasons, kept watch as best he could and made every effort not to run into or over a nest. In the Cooney,

McAbbee and Gripenstraw fields on Dower avenue, near the Almaden road, about one-half the eggs were saved, and most of these were taken to the State Game Farm. On the H. W. McComas ranch, between Agnew and Sunnyvale, there is a pear orchard of about twelve acres upon which the grass and weeds were allowed to grow quite high, and when being plowed under last April fifteen pheasant nests were turned over. Only nine eggs were saved out of all these nests.

When the hay is cut over or even around nests the pheasant hen seldom returns. Occasionally she does come back to her nest and finishes her hatch.

Pheasants in the wild state commence nesting a little earlier than those in captivity; sometimes even hatching in the winter. Last February on the Nicholson ranch, near Alviso, I saw four little pheasants a little over one-fourth grown, and on the Fisher ranch, near Coyote, a brood of about a dozen just able to fly. Of course, these must have been exceptionally early hatches.—I. L. KOPPEL.

VALLEY QUAIL SUCCESSFULLY REARED.

In the hope that the following facts regarding the breeding of valley quail may be of service to other breeders, we here detail our experiences. Three years ago there came into our possession a pair of valley quail. The female was a very young bird and was raised by hand. These birds were kept in an aviary along with many other small finches. The first year the female deposited 22 eggs, but would not incubate them; later the same year she laid 15 more and these she also deserted. The second year the first clutch contained about 18 eggs, but these were deserted. The second set was carefully incubated by the male bird, the female showing no inclination to sit on the eggs. Not a single egg hatched, however. This year, 1918, 18 eggs were deposited and the female began incubating the first part of May. Twenty-three days later she came off the nest with 16 young. One of the chicks was found dead the first morning, and several others died soon after, probably owing to the fact that the male would not hover the young at night and the female could not cover so many growing birds. Nine were brought to ma-

turity. Of this number eight are males. Another time we believe that greater success can be attained. The young quail were fed on dry weevils, and later on weed seeds, obtained as screenings from threshing machines.—H. C. BRYANT.

A DEER TRAGEDY.

The accompanying picture (Fig. 112) illustrates one of the tragedies of the woods. Notice the foot of the deer which is wedged in the fork of the oak tree. After following the trail of a coyote, I found the carcass of this deer, upon which it had been feeding. The vegetable matter on the ground having been covered by two feet of snow, the deer had put his front feet up on the trunk of the tree to reach some mistletoe on which he intended to feed. One foot slipped and caught between the forks of the tree. As the animal struggled to free himself the foot became more tightly wedged and the deer must finally have become frantic, for his leg was twisted up to the shoulder and he was lying on his back, dead. The picture was taken this year (1918), two years after the accident.—JAY C. BRUCE.

YELLOW PERCH NEAR SACRAMENTO.

The occurrence of yellow perch near Sacramento makes the history of its introduction of interest. In November, 1908, I received from the United States Bureau of Fisheries, through the Fish and Game Commission, a large number of blue-gills, sunfish and crappie; also about forty fingerling yellow or ring perch (*Perca flavescens*). These were placed in suitable localities near Sacramento. However, this was not the first introduction of these fishes into California waters, for in 1891, 3,000 yellow perch were planted in the Feather River. In 1904 I was informed that owing to the low stage of water in Nigger Jack Slough, near Marysville, large numbers of yellow perch were dying. I proceeded there immediately and saw a number of this species of fish dead in the shallow waters. There were quite a number of patients from the Yuba County Hospital catching some with hook and line in the deeper waters of the slough, some of them of good size. I immediately reported the

matter to Mr. Charles A. Vogelsang, who was chief deputy of the Commission at that time, and he sent the late deputy Manuel Cross to assist in the removal of these stranded fish to permanent waters. The presence of these fish was

Washington Lake, Yolo County, where I planted those last received from the Bureau of Fisheries. A few of them are occasionally taken in fyke nets in the Sacramento River, but in no considerable numbers.

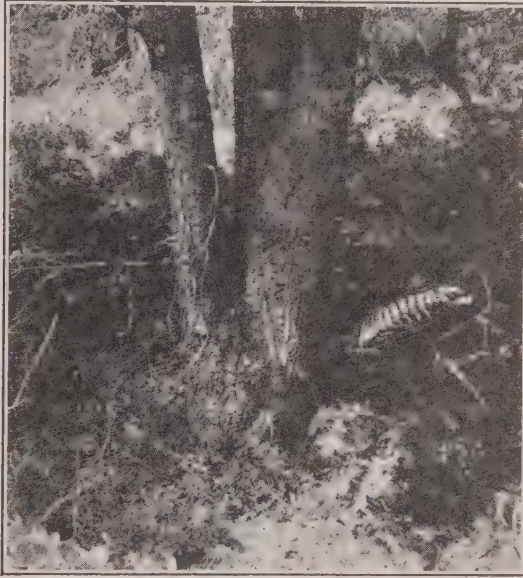


Fig. 112. Skeleton of deer which met untimely death by getting foot caught in crotch of tree. Photograph by J. C. Bruce.

doubtless the result of the Feather River planting. Conditions must have been highly favorable for them as there was a larger number of them in this body of water than I have seen in any other body of water in the valley. We removed several thousand small and adult fish to the Feather River.

Yellow perch occasionally can be found in small numbers in nearly all the interior dredger cuts and canals in the Sacramento and San Joaquin valleys, notably so in the railroad cut that runs parallel with the Sacramento Southern Railroad from Sacramento to Walnut Grove. Also in

Although these fish have a very wide distribution in the valley, they are in no wise numerous. It is my belief that our voracious fishes prefer them to most any other species for food because I have occasionally found the young in the stomachs of black and striped bass. There are two processed specimens in the Sacramento office of the Fish and Game Commission, about twelve ounces each in weight, taken from the dredger cut parallel with the Oakland, Antioch and Eastern Railroad, near Sacramento.

GEORGE NEALE.

Shad, roe	194,549	35,055	672,094				901,708
Shad, buck	159,921	13,475	230,068				403,494
Shad	199,008	101,222	633,482	57,820			993,602
Sturgeon	151,500		31				31
Sardine	167			102,416			151,500
Skate				45,173			51,609,401
Split tail							49,308
Split tail		262	74				338
Sculpin							7,658
Suckers		273	199				480
Sea trout							73
Sheepshead							1,142
Shorthead							13,034
Tom cod							1,876
Trout (farm)							455
Trout (steelhead)	485			588			73
Turbot		73		1,108			
Whitebait				85,508			107,800
Yellowtail	100	3,886					742,897
Miscellaneous				40,122	33,942		1,275
				30,173	15,098		130
		2,253					64,798
Totals	61,699	138,878	911,170	312,897	45,245	2,207,678	69,901,553
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VIOLATIONS OF FISH AND GAME LAWS.

June 1, 1918, to September 1, 1918.

Offense	Number of arrests	Fines Imposed
<i>Game.</i>		
Hunting without license-----	16	\$395 32
Failure to produce license on demand-----	1	10 00
Making false statement on application for license-----	1	25 00
Deer—close season—killing or possession-----	21	465 00
Female deer—spike bucks, fawns—killing or possession-----	23	1,218 32
Failure to retain portion of deer head bearing horns-----	1	-----
Illegal deer hides—possession-----	1	80 00
Cottontail and brush rabbits—close season—killing or pos- session-----	10	135 00
Quail—close season—killing or possession-----	9	258 32
Doves—close season—killing or possession-----	14	285 00
Ducks—close season—killing or possession-----	2	50 00
Sagehen—close season—killing or possession-----	3	65 00
Wild pigeon—close season—killing or possession-----	3	25 00
Wild pheasant—killing-----	1	25 00
Nongame birds—killing or possession-----	1	-----
Netting song birds-----	2	100 00
Trespassing—Mount Tamalpais Game Refuge-----	1	-----
Total game violations-----	110	\$3,136 96
<i>Fish.</i>		
Angling without license-----	17	\$240 00
Making false statement on application for license-----	2	50 00
Refusing to exhibit game fish on demand-----	1	30 00
Fishing for profit without license-----	1	10 00
Fishing with nets in restricted district-----	2	200 00
Trout—close season—taking, possession, offering for sale— excess bag limit-----	2	45 00
Trout—shipping by parcel post-----	1	-----
Striped bass—close season—netting—shipping from state— excess bag limit-----	9	235 00
Shad—close season—netting-----	4	60 00
Abalones—undersize—taking or possession-----	7	150 00
Crabs—undersize—taking or possession-----	1	20 00
Clams—undersize—excess bag limit—taking, possession, shipping-----	10	235 00
Pollution-----	1	-----
Dynamiting fish-----	1	200 00
Total fish violations-----	59	\$1,475 00
Grand total fish and game violations-----	169	\$4,611 96

SEIZURES—FISH, GAME, AND ILLEGALLY USED FISHING APPARATUS.

June 1, 1918, to September 1, 1918.

<i>Game.</i>	
Cottontail and brush rabbits-----	7
Quail-----	5
Doves-----	9
Ducks-----	3
Wild pigeon-----	4
Sagehens-----	14
Deer meat-----	377 pounds
Coon hides-----	21
<i>Fish.</i>	
Salmon-----	40 pounds
Shad-----	286 pounds
Trout-----	4½ pounds
Striped bass-----	23½ pounds
Abalones-----	46
Clams-----	721
Illegal nets, traps and fishing outfits-----	5
<i>Searches.</i>	
Illegal fish and game-----	21

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